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SIERRA 415A-2

LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION

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Sierra 415A-2

PCM SPAN AND REPEATER TEST SET

MAINTENANCE MANUAL

PROBE BOARD 90450006606

275

B025415A2B

Sierra
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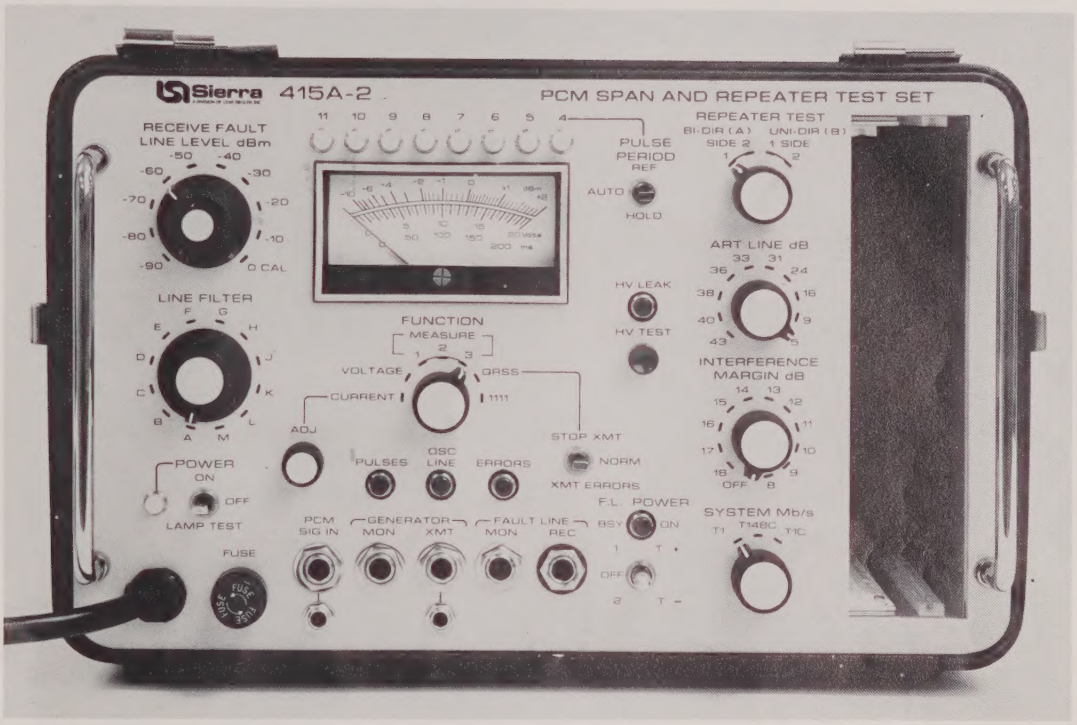

LSI/Sierra 415A-2 PCM Span and Repeater Test Set

This Maintenance Manual provides information for service and calibration center use. It is suggested that the instrument be calibrated on an annual basis, depending upon conditions and user requirements.

NOTE:

This manual reflects the current production of the 415A-2, beginning with Serial Number 1754. Earlier production units did not have a fuseholder or a Fault Line Power indicator and toggle switch on the front panel.

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1. FUNCTIONAL DESCRIPTION

1.01 The 415A-2 consists of a pattern generator, counter logic control, receiver, error detector, repeater tester, and power supply.

PATTERN GENERATOR

1.02 The pattern generator provides MEAS 1, MEAS 2, and MEAS 3, Quasi-Random Word, and "All Ones" signals. It includes various clock oscillators, pulse power output stage, and certain logic controls.

1.03 Crystal-controlled Clock Oscillators set the basic transmission speed of all generated test patterns. They are controlled by the SYSTEM Mb/s switch. Three line bit rates may be selected by the control: 1.544 Mb/s (T1), 2.364 Mb/s (T148C) and 3.152 Mb/s (T1C). The clock circuit generates a succession of precisely divided "time slots" into the Pattern Generator and its associated format-determining input circuits.

1.04 The standard Quasi-Random Word (QRW) is connected to the Pattern Generator when the FUNCTION switch is positioned to QRSS ("Quasi-Random Signal Source"). It is a repetitive sequence of 1,048,575 bits. QRW simulates an active PCM terminal by generating a similar spectrum of energy. The signal is limited to a maximum of 14 digital zeros in sequence to correspond with current system design practice. (Good repeaters can generally tolerate 14 zeros in sequence, i.e., no pulses during 14 time slots, while marginal repeaters may fail because their resonant input circuits tend to fall out of step during lengthy absence of pulses.)

1.05 At 1.544 and 3.152 Mb/s rates QRW is produced by a 20-bit shift register and associated gate circuits ("2^{20} –1" bit count). At the 2.364 Mb/s rate the clock drives a special "4B3T" (Four Binary to Three Ternary) encoder to accommodate specific line coding of the T148C-type PCM system.

NOTE: Bipolar line signals found in T1, T1C, etc. systems are referred to as AMI (Alternate Mark Inversion). Each pulse is followed by a pulse of the *opposite* polarity. By contrast, 4B3T is a special coding technique which includes frequent violations of the AMI principle.

1.06 When the FUNCTION switch is positioned to MEASURE 1, 2, or 3 the pattern generator is conditioned to produce special groups of bipolar pulses which vary at an audio rate selected by the LINE FILTER switch. When the FUNCTION switch is positioned to "1111" the pattern generator produces all "ones", that is, every time slot will be occupied by a pulse.

1.07 Output of the Pattern Generator drives the Output Amplifier, which produces a line signal of 6V peak-to-peak (3V base-to-peak). This pulse amplifier generates a pulse only when commanded by the Pattern Generator. Polarity of the pulse is also determined by the Pattern Generator.

1.08 A switch associated with the QRSS function can initiate pre-determined bipolar violations (T1, T1C only) into the Pattern Generator (XMT ERRORS) or turn off the output amplifier to momentarily stop transmission of signals (STOP XMT).

1.09 In the MEASURE 1, 2 and 3 positions the Pattern Generator can be controlled by the Counter/Logic circuit, which determines the density of pulses in the test signals. The PULSE PERIOD switch determines whether density will be lightest (REF position), or allowed to progress periodically toward greater density (AUTO), or to hold at a specific density (HOLD).

RECEIVER

1.10 The Receiver circuit includes input amplifiers and bandpass filters to process the incoming tone signal from the Fault Locating Pair. The RECEIVE FAULT LINE LEVEL control adjusts the gain of the receiver. A section of the LINE FILTER switch selects correct high and low pass filter components to provide a narrow audio bandpass at the desired frequency.

1.11 The received tone is fed into a Correlator which is conditioned to recognize the desired audio tone established by the LINE FILTER control. Output of this synchronous detector is a DC potential which varies according to the level of the received tone. Output of the Correlator drives the Meter. The correlator is essentially a finely tuned tracking bandpass filter (band-width about 20 Hz). It is capable of maintaining the narrow pass band without need for manual tuning circuits.

ERROR DETECTOR

1.12 The error detector includes all error, pulse and oscillating line detecting circuitry. The *Pulses* detector recognizes line signals and lights the PULSES lamp.

1.13 When the SYSTEM Mb/s switch is positioned at either T1, or T1C, the *AMI Errors* Detector is operative. Any violation of the alternate mark inversion rule will activate the detector and light the ERRORS lamp.

1.14 When the SYSTEM Mb/s switch is positioned to T148C, the *4B3T Errors Detector* is operative. It is designed to ignore the coded bipolar violations and light the ERRORS lamp only when violations are received out of the expected pattern.

1.15 The *Oscillating Line* Detector lights the OSC LINE lamp when it detects frequencies less than 100 kHz at the PCM SIG IN jack.

REPEATER TESTER

1.16 The Repeater Tester includes circuits for input/output interface with an inserted repeater. Components of the tester include a signal generator, an interference generator, an artificial line, and repeater voltage, current and insulation resistance test circuits.

1.17 The *Artificial Line* provides simulated characteristics of a line for testing an inserted repeater. Attenuation is varied by the ART LINE dB switch, from 5 to 43 dB loss at 772 kHz. When the GEN XMT and PCM SIG IN jacks are unoccupied the Generator signal is fed into the artificial line, and the Error Detector circuits monitor the repeater output.

1.18 *Interference* is simulated by a sine wave signal at a frequency close to one-half the bit rate selected by the SYSTEM Mb/s switch. When interference is increased (clockwise direction of the INTERFERENCE MARGIN switch) the simulated crosstalk energy should eventually cause errors at the repeater output, as indicated by a flashing ERRORS lamp. Designations on the INTERFERENCE MARGIN switch (18 through 8) are generally related to signal-to-noise ratio readings. Switch readings were calibrated on the basis of an "all ones" signal (FUNCTION switch to 1111) and 31 dB attenuation (ART LINE to 31).

POWER SUPPLY

1.19 The power supply includes regulated +5V for logic circuits, +15V and -15V for other circuits, and -200V for repeater insulation resistance testing. To test *Insulation Resistance* the HV TEST pushbutton is depressed. If less than 1 Megohm ±50%, the HV LEAK lamp will light.

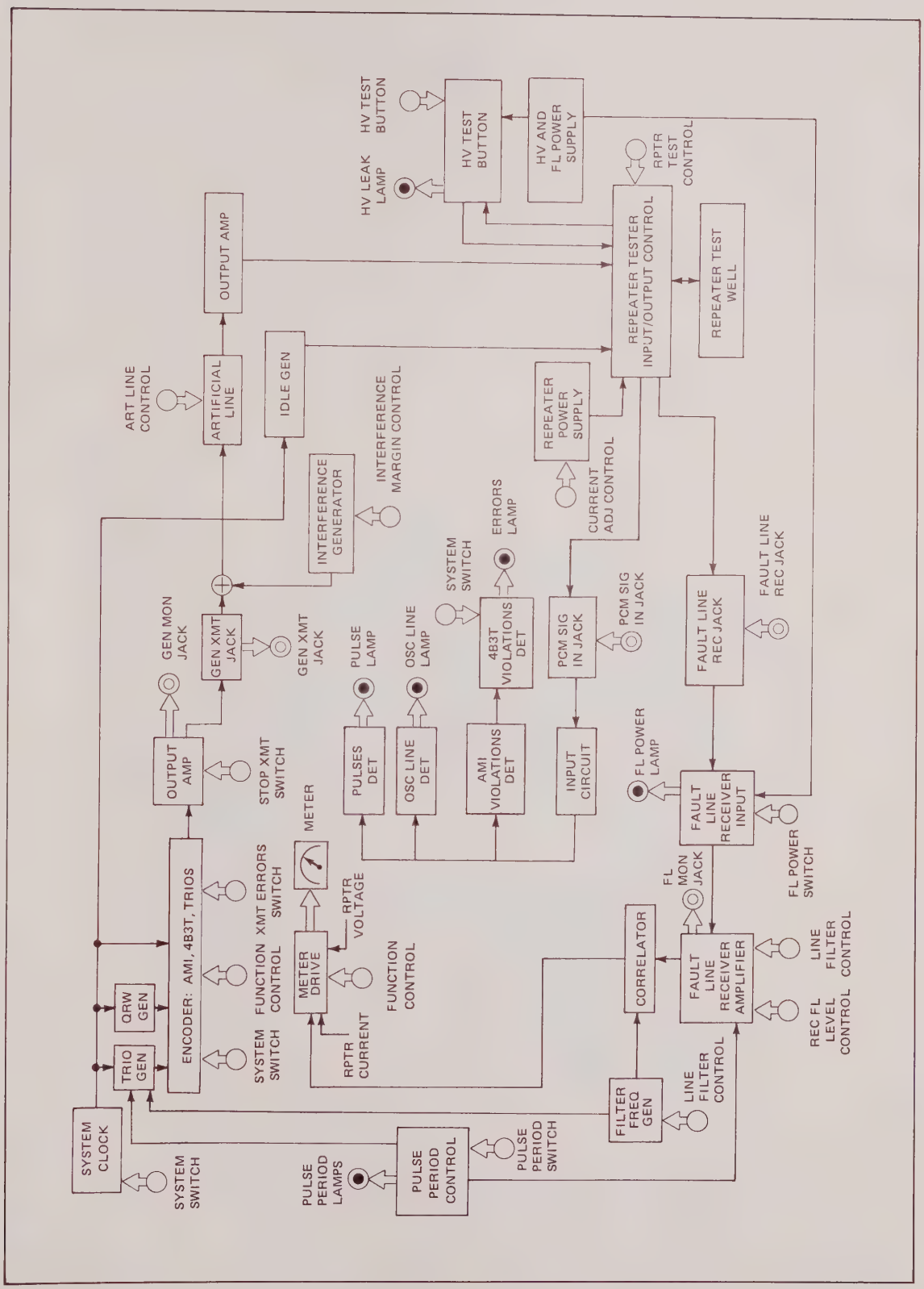


Figure 1-1. Functional Block Diagram

2. CALIBRATION

INTRODUCTION

2.01 The following calibration procedure applies to recently produced 415A-2 test sets, which will test T1, T1C, and 2.364 Mb/s T148C systems. Older units were designed to test T1, T1C, and 2.37 Mb/s T148 systems. When using this procedure on one of the older test sets, all references to 2.364 (T148C) should be read as 2.37 (T148).

Test equipment recommended for calibration of the Sierra 415A-2 is listed in Table 2-1. Alternatively, other equipment with equal or better characteristics may be used.

Table 2-1. Recommended Test Equipment

DESCRIPTION	MODEL OR PART DESIGNATION	COMMENT
Oscilloscope	Tektronix 7603	Dual trace A + B function, 50 MHz bandwidth or greater, X 10 probes
Digital Multimeter (DMM)	Dana 3300, 4300 or Fluke 8000A	1 Megohm input or greater, 1% accuracy
RMS Voltmeter	Fluke 8920	1 Megohm input or greater, 800 Hz to 3100 Hz, linear dB scale
Synthesizer	Fluke 6011A or Rockland 5100	800 Hz to 4 MHz, 500 mV to 5V, 1% distortion or less
Counter	Fluke 1900A	2 MHz or greater
Extender Board (Basic PCB)	Sierra 904500719	See Paragraph 2.03, Step 5
Test Cord	Sierra 916400037	310 to 310 plug

INTERNAL ACCESS

2.02 For access to internal parts of the 415A-2 and to various test points on PCB's, remove the instrument from its metal case as follows: (Figure 2-1 shows PC board and fuse location.)

Step 1: Remove case carrying cover and verify POWER switch is in OFF position.

Step 2: Place test set face down resting firmly on its chromeplated bails.

Step 3: Loosen captive, quarter-turn fasteners at each of four corners on test set's backside.

Step 4: Lift metal case vertically until it clears instrument.

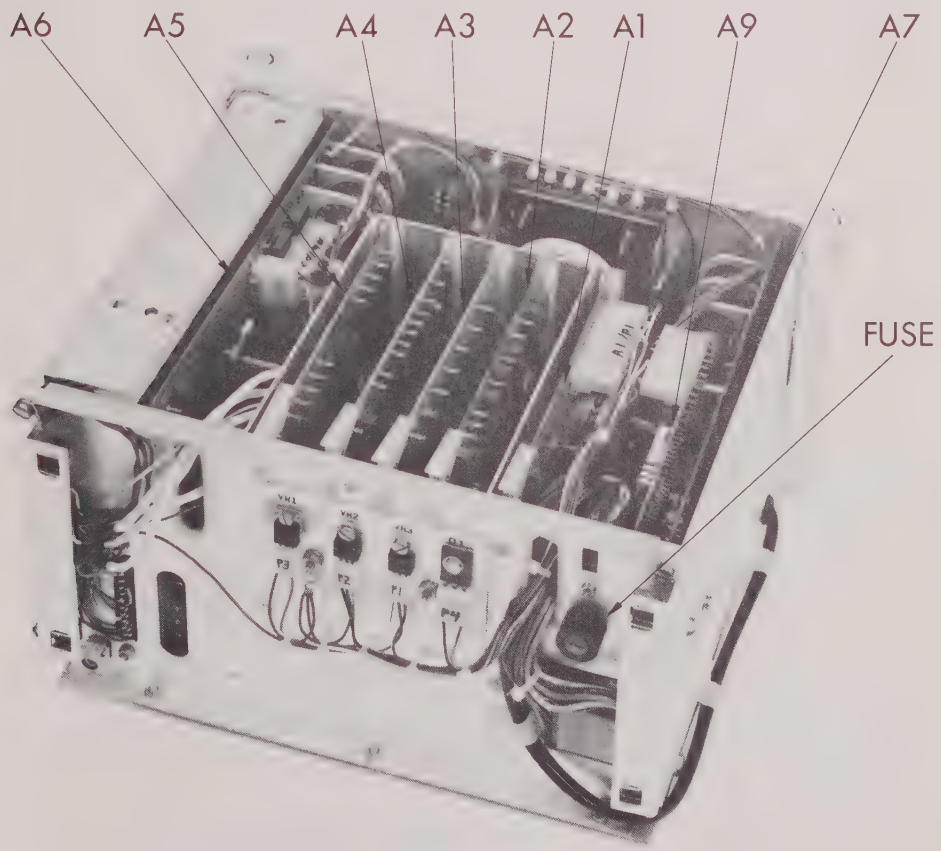


Figure 2-1. Rear View of Chassis of 415A-2 Showing Location of PC Boards and Fuse. (Beginning with Serial Number 1754, Fuse is on Front Panel)

POWER SUPPLY

2.03 Before beginning the calibration procedure, permit all test equipment to warm up for a minimum of 30 minutes. Adjust 415A-2 meter to mechanical zero to minimize error in the horizontal and vertical positions.

WARNING

WHEN TEST SET IS REMOVED FROM CASE AND POWERED ON, POTENTIALLY HAZARDOUS VOLTAGES ARE PRESENT: THEREFORE, APPROPRIATE SAFETY PRECAUTIONS MUST BE PRACTICED AT ALL TIMES WHILE WORKING ON OR AROUND EXPOSED CIRCUITS AND CONNECTORS.

Power Supply Regulation

Step 1: Set 415A-2 instrument power toggle switch to POWER ON (UP). Verify POWER lamp is illuminated.

Step 2: Using DMM, verify +5.0 ±0.3 VDC from TP3 of A1 PC board to 415A-2 chassis.

Step 3: Using DMM, verify +15 ±0.5 VDC from TP1 of A1 PC board to 415A-2 chassis.

Step 4: Using DMM, verify −15 ±0.5 VDC from TP2 of A1 PC board to 415A-2 chassis.

Power Loop Current and Voltage

Step 5: Using the basic PCB and the listed components, construct the Extender Board according to Figure 2-2. Three variable items should also be available:

(1) **Movable 750k Ohm Resistor.** Connect alligator clips to the ends of the 750k Ohm resistor.

(2) **Movable Short.** Connect alligator clips to the ends of a piece of wire to provide a movable short.

(3) **Movable Meter (DMM).** Use alligator clips or other movable contacts on the Digital Multimeter.

Step 6: Plug Extender Board into repeater test receptacle insert. Connect movable short across E3 and E4. Connect DMM across E2 and E3 with polarity as shown in Figure 2-2.

Step 7: Set 415A-2 FUNCTION selector control switch to CURRENT and rotate current ADJ pot 415A-2 front panel for DMM indication of 15.00 VDC.

Step 8: Adjust potentiometer R10 of A1 PC board for indication of 200 mA on 415A-2 meter.

Step 9: Set 415A-2 FUNCTION selector control switch to VOLTAGE, rotate current ADJ pot for DMM indication of 10.50 VDC.

Step 10: Adjust A1R27 for 415A-2 meter indication of 10.5 VDC.

Step 11: Set 415A-2 selector control switch to CURRENT and vary ADJ pot until 415A-2 meter current range span of 20 mA through 200 mA is confirmed.

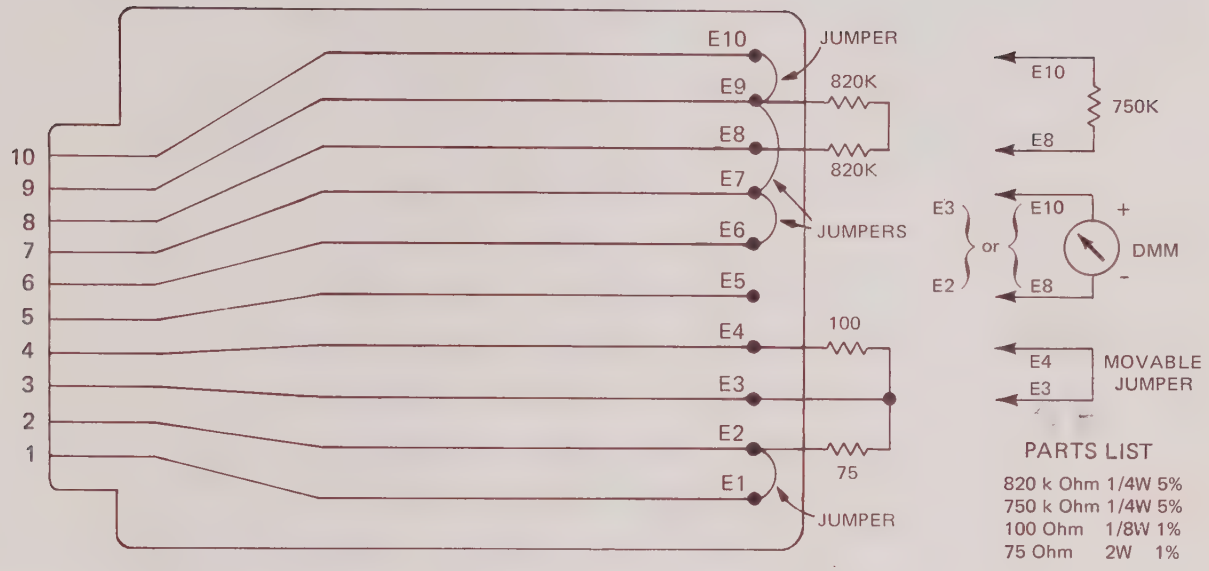


Figure 2-2. Extender Board Configuration

TRANSMITTER

2.04 Initial transmitter tests are made on the generator. Artificial line length simulator calibration and interference margin tests are done after the receiver calibration is complete.

Generator

Step 1: Set appropriate 415A-2 selector control or toggle switch as described in (a) through (d).

a. PULSE PERIOD to REF
b. FUNCTION to 1111
c. STOP XMT/NORM/XMT ERRORS to NORM
d. SYSTEM Mb/s to 1.544 (T1)

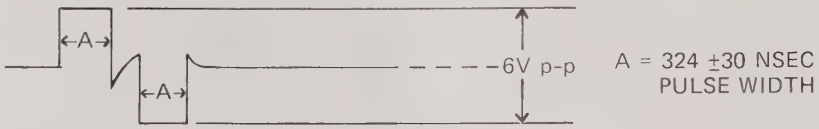
Step 2: Connect 310 plug with 100-ohm, 1/4 Watt, 1% resistor across Tip and Ring to GEN XMT jack.

Step 3: Connect oscilloscope probes across 100-ohm resistor with both probe ground leads connected to chassis ground.

Step 4: Set oscilloscope controls as listed in (a) through (e).

a. SYNC to INTERNAL
b. MODE to A + B (Added)
c. CHAN B to INVERTED
d. SENSITIVITY to 0.1 v/cm (x 10 probes) (CH A & B)
e. SENSITIVITY to 1 v/cm (x 1 probes) (CH A & B)

Step 5: Adjust oscilloscope sweep rate so that bipolar pulse pattern is present. Verify that pattern is 6.0 ±0.5 V p-p. If not, adjust R46 on A4 PC board for 6.0 V p-p.



Step 6: Set 415A-2 SYSTEM Mb/s selector control switch to 2.364 (T148C) and verify 6.0V p-p bipolar pulse pattern with pulse width of 212 ±20 nanoseconds on oscilloscope.

Step 7: Set 415A-2 SYSTEM Mb/s selector control switch to 3.152 (T1C) and verify 6.0 V p-p bipolar pulse pattern with pulse width of 159 ±25 nanoseconds on oscilloscope.

Step 8: Set 415A-2 FUNCTION selector control switch to MEASURE 1 and SYSTEM Mb/s selector control switch to 1.544 (T1). Verify that a series of pulse TRIOS are present. (Refer to Figure 2-3. It may be necessary to readjust oscilloscope sweep rate.)

Step 9: Set PULSE PERIOD toggle switch to AUTO and Verify pulse TRIOS increase in density by 648 nanoseconds for each pulse period.

Step 10: Return PULSE PERIOD toggle switch to REF and remove 310 plug from GEN XMT jack.

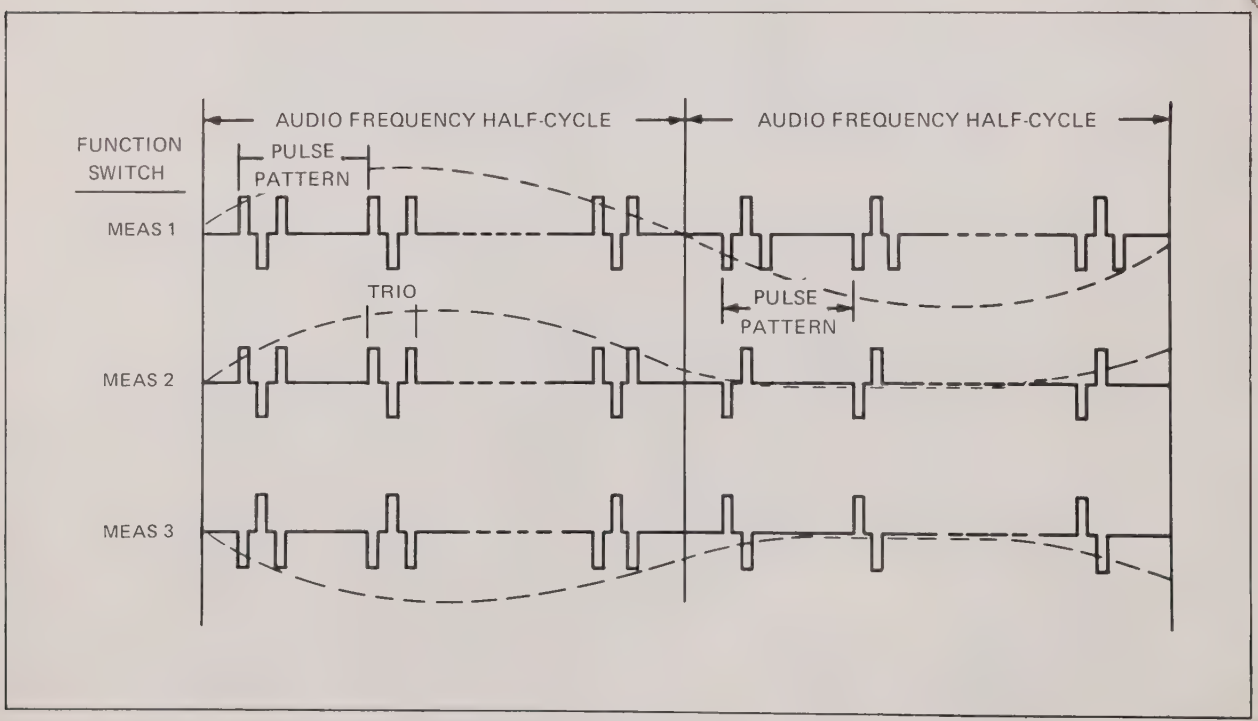


Figure 2-3. Transmitter Pulse Pattern

ERROR DETECTOR

2.05 Error detector tests include the oscillating line and drive level.

Oscillating Line

Step 1: Connect frequency synthesizer to PCM SIG IN jack and monitor input level with one channel of oscilloscope.

Step 2: Adjust frequency synthesizer for 50 kHz at 3.5 V p-p. Verify that 415A-2 OSC LINE indicator lamp illuminates.

Drive Level

Step 3: Adjust frequency synthesizer for 772 kHz at 8.0 V p-p.

Step 4: Verify that 415A-2 PULSES indicator lamp is illuminated while OSC LINE and ERRORS indicator lamps remain extinguished.

Step 5: Adjust frequency synthesizer for 772 kHz at 2.0 V p-p.

Step 6: Verify that PULSES indicator lamp is illuminated while OSC LINE and ERRORS indicator lamps remain extinguished.

RECEIVER

2.06 The receiver tests consist of verifying line filter frequencies and making correlator adjustments.

Line Filter Frequencies

Step 1: Connect frequency counter to 415A-2 between TP1 of A2 PC board and GND.

Step 2: Verify that each line filter frequency listed in Table 2-3 corresponds to appropriate LINE FILTER switch setting. Adjust R137 on A7 PCB as required, so all frequencies are within specified tolerances. (R137 is located on bottom side of unit near front panel.)

Correlator

Step 3: Connect frequency synthesizer via electrolytic 15-microfarad 20 Volt (approximate) capacitor to 415A-2 TP2 of A2 PCB. Set frequency synthesizer to 1 kHz and +20 dB.

Step 4: Connect oscilloscope to 415A-2 via TP3 of A2 PCB. Adjust R11 of A2 PCB until waveform on scope is exactly uniform in peak-to-peak amplitude (positive and negative symmetry). Slight adjustment of R15 may also be necessary.

Table 2-3. Setting and Frequency

LINE FILTER SETTING	LINE FILTER FREQUENCY
A	832 ±17 Hz
B	928 ±19 Hz
C	1048 ±21 Hz
D	1206 ±24 Hz
E	1340 ±27 Hz
F	1508 ±30 Hz
G	1722 ±34 Hz
H	2008 ±40 Hz
J	2193 ±44 Hz
K	2413 ±48 Hz
L	2680 ±54 Hz
M	3017 ±60 Hz

Step 5: After moving synthesizer connection (via decoupling cap) to TP5 and oscilloscope connection to TP6 of A2 PC board, repeat Steps 1 and 2. Adjust R35 on A2 PCB for same waveform uniformity prescribed in Step 2. Slight adjustment of R39 may also be necessary.

Step 6: Disconnect synthesizer and oscilloscope from 415A-2. Connect digital multimeter (DMM) to 415A-2 between TP7 and positive end of C10 on A2 PCB. Adjust R19 on A2 PCB for 0 ±0.002 VDC. Disconnect DMM from 415A-2.

Step 7: Set appropriate 415A-2 selector control or toggle switch as described in (a) through (e).

a. RECEIVE FAULT LINE LEVEL dBm to 0 CAL
b. ADJ Vernier control fully clockwise
c. LINE FILTER to C
d. PULSE PERIOD to REF
e. FUNCTION to MEASURE 1

Step 8: Monitor frequency at TP1 of A2 PCB on counter.

Step 9: Connect frequency synthesizer to FAULT LINE REC jack using RMS voltmeter to monitor input level.

Step 10: Adjust synthesizer for same frequency indicated on counter. Adjust synthesizer input level for 948 mv as indicated on voltmeter.

Step 11: Verify that 415A-2 meter indicates 0 dB. Adjust R23 potentiometer on PC board A2 as required for 0 dB indication.

Step 12: If 415A-2 meter indicates drift in excess of ±0.2 dB, alternately adjust R15 and R39 on PCB A2, as required, to minimize drift. Readjust R23, as required, for 415A-2 meter indication of 0 dB.

NOTE: It may be necessary to slightly adjust the synthesizer frequency to obtain the desired drift "beat" frequency and median level 415A-2 meter "peaking" indications. Once "peaking" is established, the adjustment should be within a nominal variation of ±1 Hz.

ARTIFICIAL LINE

2.07 Artificial line length simulator calibration is a continuation of the transmitter calibration.

Step 1: Disconnect movable items from Extender Board. Connect RMS Voltmeter across E3 and E4.

Step 2: Set appropriate 415A-2 selector control or toggle switch as described in (a) through (f).

a. PULSE PERIOD to REF
b. FUNCTION to 1111
c. REPEATER TEST to BI-DIR SIDE 1
d. INTERFERENCE MARGIN dB to OFF
e. ART LINE to 5
f. SYSTEM Mb/s to 1.544 (T1)

Step 3: Verify that RMS voltmeter levels conform to values shown in Table 2-2 for corresponding art line settings. For optimum compromise of tabulated values, adjust potentiometer R124 on A6 PC board as required.

Table 2-2. Art Line Code

ART LINE SETTING	RMS VOLTMETER LEVEL
5	+2.8 ±0.5 dB
9	-1.2 ±0.5 dB
16	-8.2 ±0.5 dB
24	-16.2 ±0.5 dB
31	-23.2 ±0.5 dB
33	-25.2 ±0.5 dB
36	-28.2 ±0.5 dB
38	-30.2 ±0.5 dB
40	-32.2 ±0.5 dB
43	-35.2 ±0.5 dB

* USE FLUKE 8922A (HI FREQ)
# CONNECT TO PINS 1 & 2 LOWER CONNECTOR IN REPEATER WELL. PUT 100Ω RESISTOR ACROSS (PRIMARY) MCC

INTERFERENCE MARGIN

2.08 Interference margin tests are a continuation of the transmitter calibration.

Step 1: Set 415A-2 ART LINE selector control switch to 24 and note exact reading in dB on voltmeter.

Step 2: Set 415A-2 SYSTEM Mb/s selector control switch to 2.364 (T148C) and note exact reading in dB on voltmeter.

Step 3: Set 415A-2 SYSTEM Mb/s selector control switch to 3.152 (T1C) and note exact reading in dB on voltmeter.

Step 4: Set 415A-2 SYSTEM Mb/s selector control switch to 1.544 (T1) and set INTERFERENCE MARGIN selector control switch to 10.

Step 5: Disconnect generator signal from ART LINE simulator by connecting 310 plug to GEN XMT jack.

Step 6: Verify that voltmeter level reading is 10 dB below exact reading as noted in Step 1. If required, adjust potentiometer R98 on PC board A6. (For instance, if exact value is -16.2, then -10 dB of exact value will be -26.2 dB.)

Step 7: Set 415A-2 SYSTEM Mb/s selector control switch to 2.364 (T148C) and verify that voltmeter level reading is 12 dB below exact reading noted in Step 2. If required, adjust potentiometer R99 on A6 PC board.

Step 8: Set 415A-2 SYSTEM Mb/s selector control switch to 3.152 (T1C) and verify that voltmeter level reading is 12 dB below exact reading noted in Step 3. If required, adjust potentiometer R100 on PC board A6.

Step 9: Set 415A-2 INTERFERENCE MARGIN selector control switch to OFF.

OTHER TESTS

2.09 Calibration is completed with three additional tests: performance of the high voltage leak test circuit; idle signal verification; performance of the fault line power test circuit.

High Voltage Leak

Step 1: Connect DMM to terminals E8-GND and E10. (See Figure 2-2.)

Step 2: Press REPEATER TEST/HV TEST pushbutton switch on 415A-2 and read digital voltmeter (CAUTION, HIGH VOLTAGE). Verify that voltage reading is within ±10% of -200 volts. Verify that the 415A-2 HV LEAK lamp remains extinguished.

PIN 10 AND GROUND (PIN 8) UPPER CONNECTOR REPEATER

Step 3: Turn OFF 415A-2 and connect 750k resistor across pins E8 and E10 in parallel with the existing resistors.

Step 4: Turn ON 415A-2 and press REPEATER TEST/HV pushbutton switch. Verify that HV LEAK lamp illuminates.

Idle Signal Verification

Step 5: Disconnect RMS voltmeter from extender board and connect one channel of oscilloscope across 100-Ohm resistor E3 (GND) and E4 (Signal).

Step 6: Set 415A-2 REPEATER TEST selector control switch to BI-DIR SIDE 2 and set SYSTEM Mb/s selector control switch to 1.544 (T1).

Step 7: Verify that scope displays sinewave 340 ±70 mv p-p.

Step 8: Set 415A-2 SYSTEM Mb/s selector control switch to 2.364 (T148C) and verify that scope displays sinewave 250 ±5 mv p-p.

Step 9: Set 415A-2 SYSTEM Mb/s selector control switch to 3.152 (T1C) and verify that scope displays sinewave 130 ±25 mv p-p.

Step 10: Return 415A-2 SYSTEM Mb/s selector control switch to 1.544 (T1) position.

Step 11: Remove extender board from repeater well and 310 plug from GEN XMT jack.

Fault Line Power

Step 12: Turn the F. L. POWER (FAULT LINE POWER) switch OFF. Verify that the F. L. POWER indicator is **not** lit.

Step 13: Connect the DMM to the FAULT LINE REC jack using a cord with a 310 plug. Connect plug so that tip goes to positive (+) lead of meter, and ring to negative (–). Connect the lead from the sleeve of the 310 plug to the chassis of the 415A-2 test set. (The sleeve on this jack is not connected internally to the test set chassis.)

Step 14: Set F. L. POWER switch to +.
Verify that (1) the DMM reads +117 V ±12V and (2) the F. L. POWER indicator is lit.

Step 15: Set F. L. POWER switch to –.
Verify that (1) the DMM reads –117 V ±12V and (2) the F. L. POWER indicator is lit.

Step 16: Disconnect the lead from the sleeve of the 310 plug from the chassis of the 415A-2. Verify that (1) the DMM reads 0 V and (2) the F. L. POWER indicator is **not** lit. (A change takes about 3 seconds.)

Step 17: Set the F. L. POWER switch to OFF.

CALIBRATION VERIFICATION

2.10 To insure that the test set is working correctly, you may wish to perform this optional operational test. It is suggested that this test be performed periodically. If results deviate significantly from anticipated results, servicing may be necessary.

Operational Test		
Step	**Procedure**	**Result**
1	Connect Power cord.	
2	Momentarily depress POWER switch to LAMP TEST position.	All front panel lamps light.
3	Set POWER switch to ON.	POWER lamp lights.
4	Connect a patch cord from the GEN MON jack to the FAULT LINE REC jack.	
5	Set SYSTEM Mb/s to 1.544 (T1).	
6	Set LINE FILTER switch to A.	
7	Set the PULSE PERIOD switch to REF.	Lamp 11 lights.
8	Set the FUNCTION switch to MEASURE 1.	
9	Adjust the RECEIVE FAULT LINE LEVEL control to –60, then adjust vernier control for a meter reading of 0 dB.	
10	Set the FUNCTION switch to MEASURE 2 position.	Meter should read between –5 and –7 dB.
11	Set the FUNCTION switch to the MEASURE 3 position.	Meter should read within 1.0 dB of Step 10.
12	Reset the FUNCTION switch to the MEASURE 1 position.	
13	Switch PULSE PERIOD switch to AUTO.	PULSE PERIOD lamps light in sequence 11 through 4. Meter reading will rise with each step. Maximum increase is 2.2 dB for T1 and T148C, 2.5 dB for T1C, when lamp 4 is lit.
14	Reset PULSE PERIOD switch to REF.	
15	Rotate the LINE FILTER switch through all the settings, then return to A.	Meter reading should increase approximately 1.3 dB per step.
16	Rotate the SYSTEM Mb/s switch to 2.364 (T148C) and 3.152 (T1C). In each position, repeat steps 9 through 14.	

Operational Test (continued)		
Step	**Procedure**	**Result**
17	Return the SYSTEM Mb/s switch to 1.544 (T1)	
18	Connect patch cord from GEN MON jack to PCM SIG IN jack.	
19	Rotate the FUNCTION switch through MEASURE 1, 2, and 3 positions.	PULSES and ERRORS lamps light.
20	Set FUNCTION switch to QRSS and toggle switch to NORM.	PULSES lamp lights; ERRORS lamp off.
21	Set toggle switch to XMT ERRORS.	ERRORS lamp flashes.
22	Set toggle switch to STOP XMT.	PULSES and ERRORS lamps go out.
23	Set FUNCTION switch to 1111 and toggle switch to NORM.	PULSES lamp lights; ERRORS lamp off.
24	Set toggle switch to XMT ERRORS.	ERRORS lamp flashes in T1 & T1C; does not flash in T148C.
25	Set toggle switch to STOP XMT.	PULSES and ERRORS lamps go out.
26	Reset toggle switch to NORM.	
27	Rotate the SYSTEM Mb/s switch through to 2.364 (T148C) and 3.152 (T1C). In each position, repeat steps 19 through 26	

Remove patch cable, install B; Dir repeater. Set current to 60mA.
SET Function to QRSS
Check pulses lamp on and check you can Xmit errors
Check for 10db difference between Gen Mon and Xmt

3. TECHNICAL DATA

SPECIFICATIONS

3.01 Specifications are shown in Table 3-1.

Table 3-1. 415A-2 Specifications

PULSE TRANSMITTER	
Bit Rate (switchable):	1.544 (T1), 2.364 (T148C), or 3.152 (T1C) Mb/s
Time Slots:	1.544: 648 ns 2.364: 423 ns 3.152: 317 ns
Pulse Width, Nominal:	1.544: 324 ns 2.364: 212 ns 3.152: 159 ns
Pulse Rise or Fall Time:	1.544: 80 ns 2.364: 50 ns 3.152: 30 ns
Pulse Overshoot:	10 to 30% of pulse amplitude
Pulse Amplitude:	±3V ±10% base-to-peak (6V ±10% peak-to-peak)
Audio Component Frequencies (Hz):	A 832, B 928, C 1048, D 1206, E 1340, F 1508, G 1722, H 2008, J 2193, K 2413, L 2680, M 3017
Audio Component Accuracy:	±2%
Interference Margin Signal:	Sine wave, level adjustable from 8 to 18 dB below level of all 1's signal at repeater input. 1.544 (T1): 770 kHz 2.364 (T148C): 1.179 MHz 3.152 (T1C): 1.570 MHz
FAULT LINE RECEIVER	
Filter Frequencies:	Same as transmitter audio component frequencies
Input Range:	-90 dBm to 0 dBm
Input S/N Requirement:	15 dB S/N minimum in a ±10 Hz bandwidth centered on desired fault locating frequency.
Input Impedance:	900 ohms ±10%
Level Reading Accuracy:	±1.0 dB at 0 dBm on meter; ±2.0 dB at -10 dBm on meter
Meter Accuracy:	±3% of full scale
Common Mode Rejection:	60 dB minimum at 4 kHz
PCM Signal Input:	±1.0 to ±4.0 V, base-to-peak (2.0 to 8.0 V peak-to-peak)
High Voltage:	200 ±10% VDC. Lamp ON indicates less than 1 Megohm insulation resistance ±50%.
Temperature Range:	Operating: 0 to +50°C Storage: -40 to +65°C Maximum Humidity: 95%
Power:	115/230 VAC ±10%, 47.5 to 66 Hz
Dimensions, Nominal: (without cover)	Approximately 7.5 inches H x 12 inches W x 9.5 inches D
Weight	Approximately 15.5 pounds

ORDERING INFORMATION

3.02 The basic 415A-2 is mounted in a portable carrying case with a detachable cover. The optional inserts for local testing are shown in Table 3-2 and are ordered separately.

Table 3-2. Inserts and Accessories

INSERT PART NO.	APPLICATION
C02700502	Standard T1 (such as WECo 201/205)
C02699001	Standard T1 (such as Vicom 1550-01)
C02979601	Mini T1 (such as WECo 238/239)
C02979602	Mini T1 (such as WECo 239E)
C03146900 246A-4	SLC 40 (such as WECo 217A) & 3-ft Cable
C03147000	T1C (such as WECo 248/249)
C03396700	T1C Bidirectional
C02776900	WECo 206 Office Rptr
C03187700	WECo 220 Office Rptr
D02986700	Lenkurt 91112 Office Rptr (w/48V cord)
C03187800	Lenkurt 91124/91141 Office Rptr
ACCESSORIES P/N	**DESCRIPTION**
913200033	Fuse, 115V: 1/4 A, slow blow, 250V
913200050	Fuse, 230V: 1/8 A, slow blow, 250V
913800060	Lamp, 5V, 20 mA incandescent, T1 Flange Base
921000075	Canvas Carrying Case
916400037	Test Cord, 6-ft. (310 to 310 plug)
243A-4	Test Cord, 6-ft. (310 to alligator clips)

4. SCHEMATICS AND PARTS LISTS

4.01 Section 4 includes the schematics and parts lists for each subassembly of the 415A-2 test set. The information applies to the instruments as produced in Sierra's factory at the date of this manual.

If this manual is being used for maintenance and repair on an instrument made at another time, the user must recognize that differences may exist between the manual information and the hardware.

Test set improvements have been made on a continuing basis since the instrument was first introduced. Generally, the information contained in this manual applies to all 415A-2 test sets.

When specific information does not appear to apply to the instrument under test, the user should call the Customer Service Department at the factory, giving the model number, serial number and date of purchase. The Sierra representative will provide the needed instructions and information to augment the material given in this section.

Description	Drawing Number
Interconnect Diagram	D03213900 (3 pages)
Circuit Boards:	
A1 Power Supply and Meter Drive	D03407700 (2 pages)
A2 Correlator	D03197700 (1 page)
A3 Error Detector	D03197800 (2 pages)
A4 Pattern Generator, Output Driver	D03197900 (2 pages)
A5 QRW and 4B3T Generator	D03198000 (2 pages)
A6 Repeater Tester	D03198200 (2 pages)
A7 Receiver	D03408300 (2 pages)
A8 Mother Board	D03407900 (1 page)
A9 Pulse Period Gain Comp, Lamp Driver	D03198600 (1 page)
Front Panel Assembly	D03159700 (page 1 only)

NOTE: For those who do their own maintenance and repair, it may be desirable to stock a set of spares so that out-of-service time can be kept to a minimum. Factory service records indicate that the Recommended Spares in Table 4-1 will meet most emergencies.

Table 4-1. Recommended Spares

SIERRA PART NUMBER	DESCRIPTION	QTY.
901400503	Capacitor, ceramic disc 0.05 µF	2
901900680	Capacitor, dipped Mica 68 pF 2%	1
907306040	Resistor, Film, Metal 604 Ohm , 1/8 W 1%	1
907349R90	Resistor, Film, Metal 49.9 Ohm 1/8 W 1%	3
907361R90	Resistor, Film, Metal 61.9 Ohm 1/8 W 1%	3
910000136	Transformer Assembly	2
910304258	Logic Switch, SI, 2N4258, PNP	3
910633051	Zener Diode, 1N3051B	1
911200263	Switch, Rotary, S1	2
911200276	Switch, Rotary, 1 Pole, 12 POS	1
911200277	Switch, Rotary, 1 pole, 10 POS	1
911800160	Meter, M1	3
912200191	Crystal, 6.176 MHz	1
912200193	Crystal 12.608 MHz	2
912400004	Oscillator Crystal Controlled Clock, 6.3 MHz	1
913400012	Fuse Holder, Screwdriver Slot	2
913800060	Lamp, Incandescent, T1 flange base	5
913800063	LampHolder, white without lamp	2
913800065	Lamp Holder, Red without lamp	1
914400036	Phone Jack	3
914800120	Connector, PCB, 12 PIN	3
914800151	Contact Housing, 10 Dual Position	2
914800196	Connector Receptacle, Shell, 5 Pin, Nylon	3
914810073	Connector Receptacle, 10 Circuit, PC	2
915600012	Bumper, Rubber, No-Mar Black	2
920300301	I. C., LM301AN, Operational Amplifier	2
920300555	I. C., NE555 V LM555CN, Timer	1
920301596	I. C., MC1596L, Modulator - Demodulator	2
920304136	I. C., RCA136, Quad, Operational Amplifier	5
920307428	I. C., SN74LS28, Quad, 2-Input NOR Gate	3
920307805	I. C., 7805UC, +5 Volt Regulator	1
920317420	I. C., SN74LS20, Dual 4 Input NAND Gate	2
920317427	I. C., SN74LS27, Triple 3 Input NOR Gate	2
920317473	I. C., SN74LS75N, Dual J-K Flip Flop	3
920317474	I. C., SN74LS74, Dual Flip Flop W/Preset & Clear	2
920317486	I. C., SN7486PC, Quad, 2 Input Exclusive OR Gate	3
920327400	I. C., SN74LS00N, Quad, 2 Input NAND Gate	3
920327410	I. C., SN74LS10N, Triple, 3 Input NAND Gate	3
920337402	I. C., SN74LS02N Quad, NOR Gate	2
920337496	I. C., SN74LS96, 5 Bit Shift Register	1
920374197	I. C., SN74LS19M, Binary Counter/Latch	3
920400032	Meter Bezel	3

THIS DRAWING AND SPECIFICATIONS SHOWN SHALL NOT BE COPIED OR USED WITHOUT WRITTEN CONSENT OF LEAR SIEGLER, INC., SIERRA ELECTRONIC DIVISION

CHANGE EFFECTIVE			REVISIONS			
MODEL	SERIAL	ZONE	LTR	DESCRIPTION	DATE	APPROVED
			A	PILOT RUN RELEASE	6-26-76	FAULL
			A2	PCO 1478, 1563 RAM	8-18-76	MLD
			A6	PCO 1988, 1989, 1990, 2015		
			B	PREPRODUCTION RELEASE	2/7/77	Faull
				PRODUCTION RELEASE	6777	Faull
			C	ECO 16993	10-17-79	Faull
415A-2	1754 & UP	—	D	ECO 17687	3-26-80	"
415A-2	1754 & UP	—	E	ECOS 17821 & 17869	8-15-81	MH
			F	PER ECO 17977 LM	5/16/82	Finnegan
			G	PER ECO 19272 P.E.P	10/29/84	

PART OF A1

ASSY A03149101
SCHEM D03197600

J1 P1

13	YELLOW
6	BLU
14	WHT/ORN
12	WHT/RED
15	BRN — NC
1	— NC
4	
10	BLK
5	GRN — SEE SHEET 2, J2-6
3	ORN
11	WHT/BRN
2	RED
7	VIO
9	WHT
8	GRY

TRANSISTOR ASSY
ASSY C03160700

P5
1	E
2	C
3	B

Q2
2N5655

E3

P1
1	IN
2	GND
3	OUT

VR3
78M15UC

P2
1	IN
2	GND
3	OUT

VR2
7805UC

P3
1	GND
2	IN
3	OUT

VR1
MC7915CP

P4
1	E
2	C
3	B

Q1
MJE3055

A3
ASSY A03149501
SCHEM D0319800
ERROR DETECTOR

P1 XA3: A 1 B 2 C 3 D 4 E 5 F 6 H 7 J 8 K 9 L 10 M 11 N 12 P 13 R 14 S 15

A4
ASSY A03149701
SCHEM D03197900

P1 XA4: A 1 B 2 C 3 D 4 E 5 F 6 H 7 J 8 K 9 L 10 M 11 N 12 P 13 R 14 S 15 T 16 U 17 V 18

A5A
ASSY A03149900
SCHEM D03198000
QRW & 483T GENERATOR

P1 XA5: A 1 B 2 C 3 D 4 E 5 F 6 H 7 J 8 K 9 L 10 M 11 N 12 P 13 R 14 S 15

PART OF A8

ASSY D03156900
SCHEM D03158500
MOTHERBOARD

XA1: A 1 B 2 C 3 D 4 E 5 F 6 H 7 J 8 K 9 L 10 M 11 N 12 P 13 R 14 S 15 T 16 U 17 V 18

XA2: A 1 B 2 C 3 D 4 E 5 F 6 H 7 J 8 K 9 L 10 M 11 N 12 P 13 R 14 S 15

P1

ASSY A03149101
SCHEM D03197600
POWER SUPPLY/METER DRIVE
A1

P1

ASSY A03149300
SCHEM D03197700
CORRELATOR
A2

NOTES - UNLESS OTHERWISE SPECIFIED:
1. ▭ DENOTES FRONT PANEL MARKINGS
2. FUSE: 115VAC, 1/4 AMP, SLOW BLOW
   230VAC, 1/8 AMP, SLOW BLOW
3. SWITCH SHOWN IN 115VAC POSITION
4. ALL RESISTANCE VALUES ARE IN OHMS.

QTY	QTY	QTY	QTY	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
						LIST OF MATERIAL OR PARTS LIST		

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED

FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED

DO NOT SCALE DWG

DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED

TOLERANCE UNLESS SPECIFIED	TWO PLACE	THREE PLACE
BASIC		
UP TO 6	± .02	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION ±		

FINISH:

Sierra
LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION
MENLO PARK, CALIFORNIA 94025

CODE IDENT. NO. 54778

INTERCONNECT DIAGRAM
415A-2

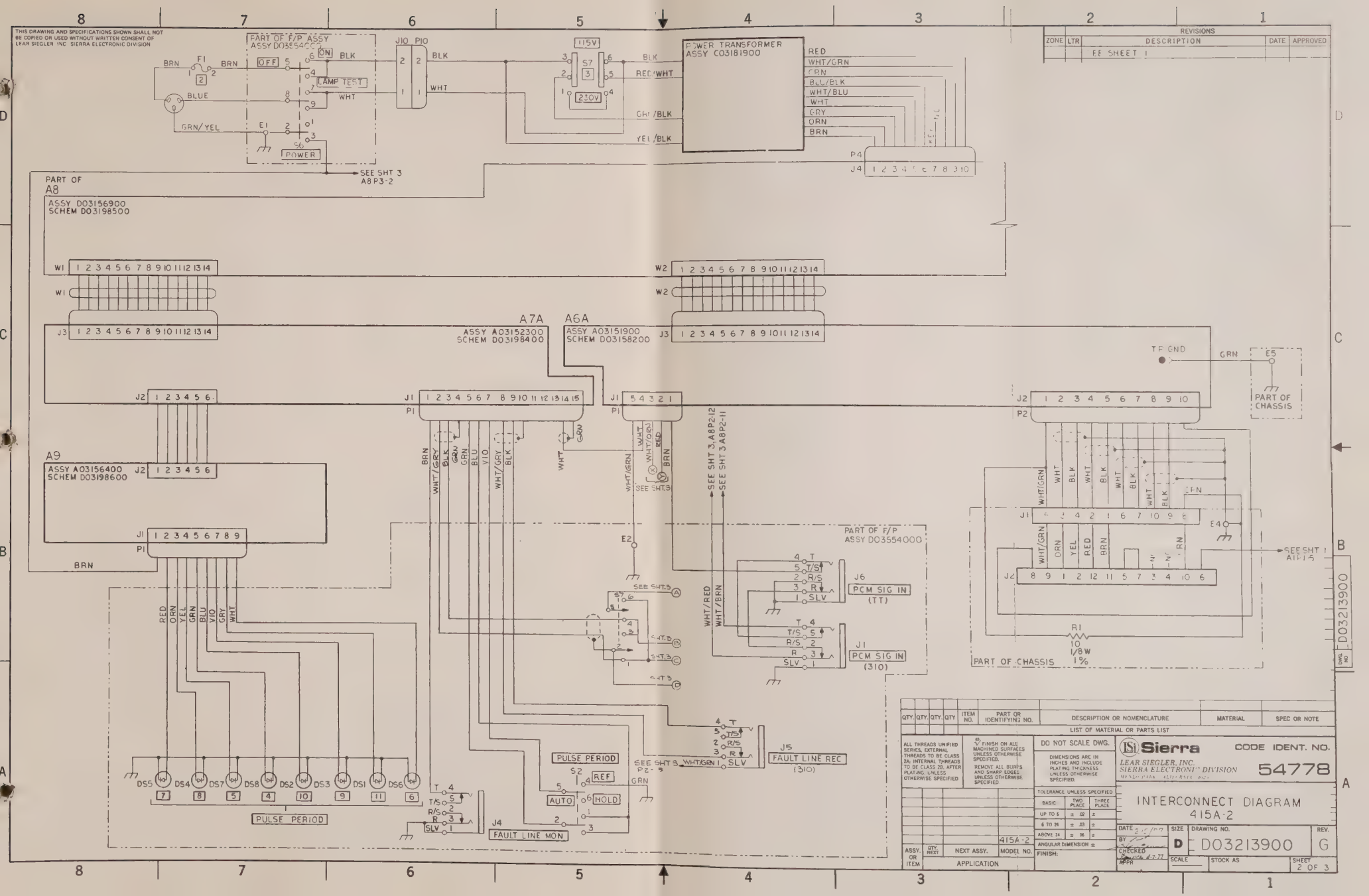
ASSY OR ITEM	QTY NEXT	NEXT ASSY.	MODEL NO.	APPLICATION
			415A	

DATE 4-76
BY
CHECKED
APPR

SIZE D | DRAWING NO. D03213900 | REV. G

SCALE | STOCK AS | SHEET 1 OF 3

DWG NO D03213900


THIS DRAWING AND SPECIFICATIONS SHOWN SHALL NOT BE COPIED OR USED WITHOUT WRITTEN CONSENT OF LEAR SIEGLER INC SIERRA ELECTRONIC DIVISION
REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
EE SHEET 1
PART OF F/P ASSY ASSY D03554000
F1
S6
POWER
LAMP TEST
OFF
ON
J10 P10
115V
230V
S7
POWER TRANSFORMER ASSY C03181900
P4
J4
SEE SHT 3 A8P3-2
PART OF A8
ASSY D03156900
SCHEM D03198500
W1
W2
J3
A7A
ASSY A03152300
SCHEM D03198400
A6A
ASSY A03151900
SCHEM D03158200
TP GND
E5
PART OF CHASSIS
J2
J1
P1
P2
A9
ASSY A03156400
SCHEM D03198600
SEE SHT 3
SEE SHT 3 A8P2-12
SEE SHT 3 A8P2-11
E2
E4
PART OF F/P ASSY D03554000
J6
PCM SIG IN (TT)
J1
PCM SIG IN (310)
R1
10 1/8W 1%
PART OF CHASSIS
SEE SHT 1 A1P1-5
DS5 DS4 DS7 DS8 DS2 DS3 DS1 DS6
PULSE PERIOD
J4
FAULT LINE MON
J5
FAULT LINE REC (310)
S2
REF
AUTO
HOLD
SEE SHT 3 P2-5
QTY. ITEM NO. PART OR IDENTIFYING NO. DESCRIPTION OR NOMENCLATURE MATERIAL SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST
ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED
FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DWG.
DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.
TOLERANCE UNLESS SPECIFIED
BASIC TWO PLACE THREE PLACE
UP TO 6 ± .02 ±
6 TO 24 ± .03 ±
ABOVE 24 ± .06 ±
ANGULAR DIMENSION ±
FINISH:
Sierra
LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION
CODE IDENT. NO. 54778
INTERCONNECT DIAGRAM 415A-2
DRAWING NO. D03213900 REV. G
SIZE D
SCALE
STOCK AS
SHEET 2 OF 3
ASSY. OR ITEM QTY. NEXT NEXT ASSY. MODEL NO. 415A-2
APPLICATION
DRAWN CHECKED APPR
D03213900

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REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1		

PART OF
A8
ASSY D03156900
SCHEM D03198500

PART OF F/P
ASSY D03554000

J3 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
P3

J2 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
P2

J1 15 14 13 12 11 10 9 8 7 6 5 4 3 2
P1

WHT/GRN
WHT/YEL
BLK
WHT/GRY
WHT/BRN
BLK
WHT
GRY
VIO
BLU
GRN
YEL
ORN
BRN

RED → SEE SHT 2 S6-3

SEE SHT 2 J5 SLV — WHT/GRN
SEE SHT 2 J1-R — WHT-RED
SEE SHT 2 J1-T — WHT/BRN

NC

R1 25K

S4
NORMAL
XMIT ERRORS
STOP XMIT

S1-A (FRONT) CW
S1-B (FRONT) CW
FUNCTION
S1-A (REAR) CW

J7 GENERATOR XMT (TT)
J3 GENERATOR XMT (310)
J2 GENERATOR MON

T
T/S
R/S
R
SLV

M1

DS14

S3

FROM SHT 2

SEE SHT 2 (Y)
SEE SHT 2 (X)

FROM SHT 2 B C D

DS12 PULSES
DS11 OSC LINE
DS10 ERRORS
DS9 HV LEAK
DS13 POWER

QTY.	QTY.	QTY.	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST							

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED

√ FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED

DO NOT SCALE DWG.
DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .02	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION ±		
FINISH:		

Sierra
LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION
MENLO PARK, CALIFORNIA 94025

CODE IDENT. NO. 54778

INTERCONNECT DIAGRAM
415A-2

ASSY. OR ITEM	QTY. NEXT	NEXT ASSY.	MODEL NO
APPLICATION			415A-2

DATE 2-4-77
BY
CHECKED
APPR 4-7-77

SIZE D
DRAWING NO. D03213900
REV. G
SCALE
STOCK AS
SHEET 3 OF 3

D03213900

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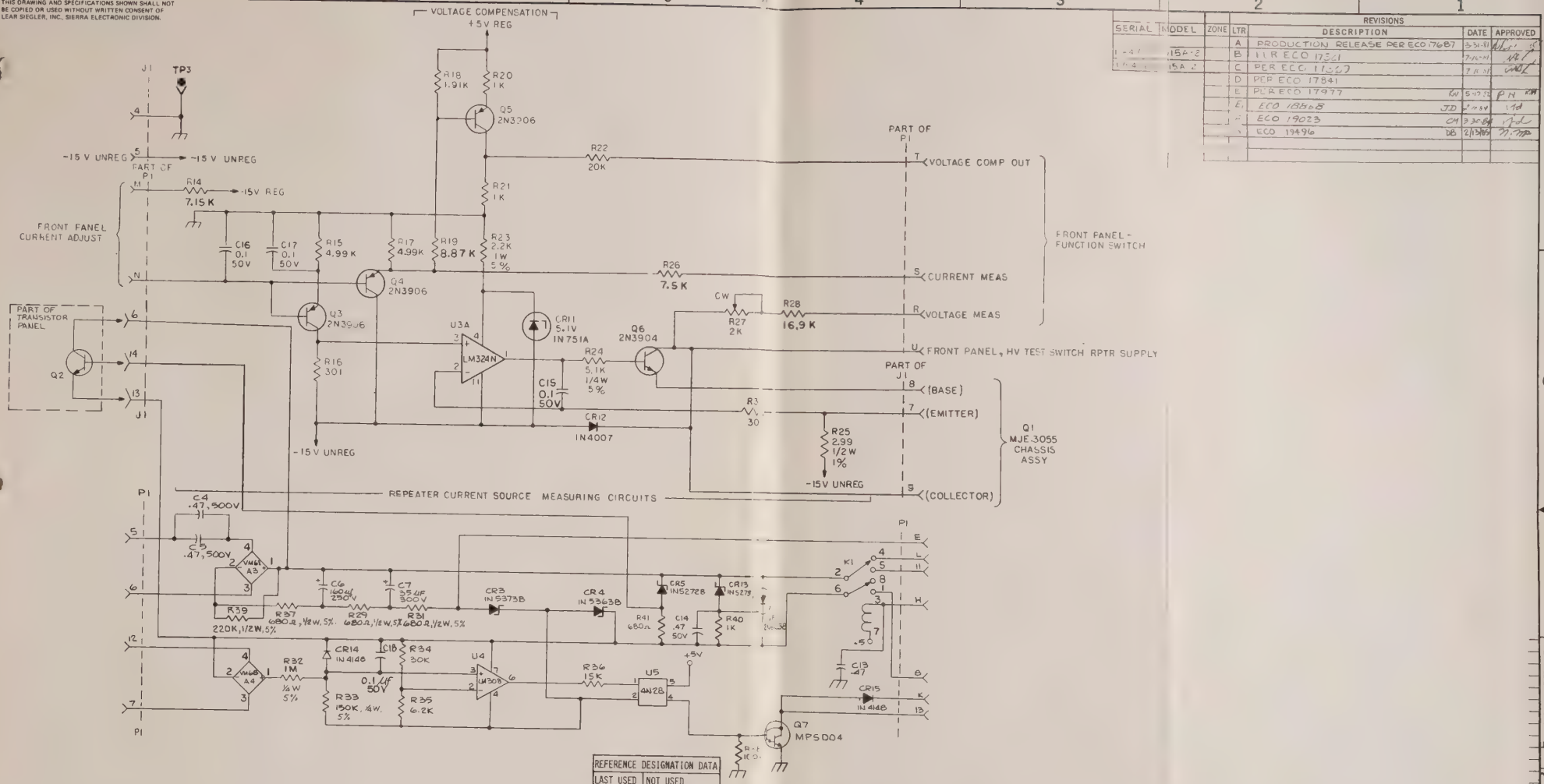


REFERENCE DESIGNATION DATA	
LAST USED	NOT USED
A4	—
C17	C8
CR16	—
J1	—
K1	—
Q8	—
R41	—
U5	—

NOTES - UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL RESISTORS ARE 1/8W, ±1%
3. ALL CAPACITANCE VALUES ARE IN MICROFARADS

[4] SEE TABLE "A"

SERIAL	MODEL	ZONE
1-47	415A-2	
1748 -	415A-2	

REVISIONS				
LTR	DESCRIPTION		DATE	APPROVED
A	PRODUCTION RELEASE PER ECO 17687		3-31-81	
B	PER ECO 17741		7-10-81	
C	PER ECO 17827		7-28-81	
D	PER ECO 17841			
E	PER ECO 17977	KW	5-13-82	PN
F	ECO 18568	JD	2-11-84	
G	ECO 19023	CM	3-30-84	
H	ECO 19496	DB	2-13-85	

QTY.	QTY.	QTY.	QTY.	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST								

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED

FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED

DO NOT SCALE DWG.

DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .02	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION	±	
FINISH:		

Sierra
LEAR SIEGLER INC
SIERRA ELECTRONIC DIVISION
MENLO PARK, CALIFORNIA 94025

CODE IDENT. NO. 54778

415A-2, SCHEMATIC, AI POWER SUPPLY/METER DRIVE

ASSY OR ITEM	QTY. NEXT	NEXT ASSY.	MODEL NO.
APPLICATION			415A-2

DATE 2-3-81 BY NGA LE CHECKED APPR

SIZE D | DRAWING NO. D03407700 | REV. C

SCALE | STOCK AS | SHEET 1 OF 2

D03407700

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A1 PCB	Power Board Assembly for 415A-2	A03407800
A1	Rectifier Bridge VE47	910800031
A2	Rectifier Bridge VE47	910800031
A3	Rectifier Bridge VM68	910800068
A4	Rectifier Bridge VM68	910800068
C1	Capacitor Electrolytic 1000 uF 50V	902270108
C2	Capacitor Electrolytic 1000 uF 50V	902270108
C3	Capacitor Electrolytic 3300 uF 25V	902210338
C4	Capacitor Ceramic .47 uF 400V	901310474
C5	Capacitor Ceramic .47 uF 400V	901310474
C6	Capacitor Electrolytic 160 uF 250 VDC	902230157
C7	Capacitor Electrolytic 35 uF 300 VDC	902210356
C9	Capacitor Plastic 1.0 uF 25V	903300105
C10	Capacitor Tantalum 10 uF 10% 20V	902720106
C11	Capacitor Tantalum 1 uF 10% 35V	902740105
C12	Capacitor Tantalum 1 uF 10% 35V	902740105
C13	Capacitor Ceramic .47 uF 400V	901310474
C14	Capacitor Ceramic .47 uF 20% 50V	901300474
C15	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C16	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C17	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C18	Capacitor Ceramic 0.1 uF 20% 50V	901300104
CR 01	Diode Zener 1N4731A 4.3V 5% 1W	910634731
CR 02	Diode Zener 1N4731A 4.3V 5% 1W	910634731
CR 03	Diode 1N5373A Zener	910635373
CR 04	Diode 1N5363B Zener	910635363
CR 05	Diode Zener 1N5272B	910635272
CR 06	Diode SI 1N4148 75V 150mA 500mW	910504148
CR 07	Diode Zener 1N961B 10V 5% 400mW	910630961
CR 08	Diode 1N191 90V	910500191
CR 09	Diode SI 1N4148 75V 150mA 500mW	910504148
CR 10	Diode SI 1N4148 75V 150mA 500mW	910504148
CR 11	Diode Zener 1N751A 5.1V 5% 400mW	910630751
CR 12	Diode 1N4007	910804007
CR 13	Diode Zener 1N5273B	910635273
CR 14	Diode 1N4148	910504148
CR 15	Diode 1N4148	910504148
CR 16	Diode 1N5818	910805818
J1	Connector 15 Pin Molex	914800195
K1	Relay 28V DPDT	912600096
Q1	Transistor SI 2N3904 NPN	910303904
Q2	Transistor SI 2N3904 NPN	910303904
Q3	Transistor SI 2N3906 PNP	910303906
Q4	Transistor SI 2N3906 PNP	910303906
Q5	Transistor SI 2N3906 PNP	910303906
Q6	Transistor SI 2N3904 NPN	910303904
Q7	Transistor Darlington MPS D04	910310004

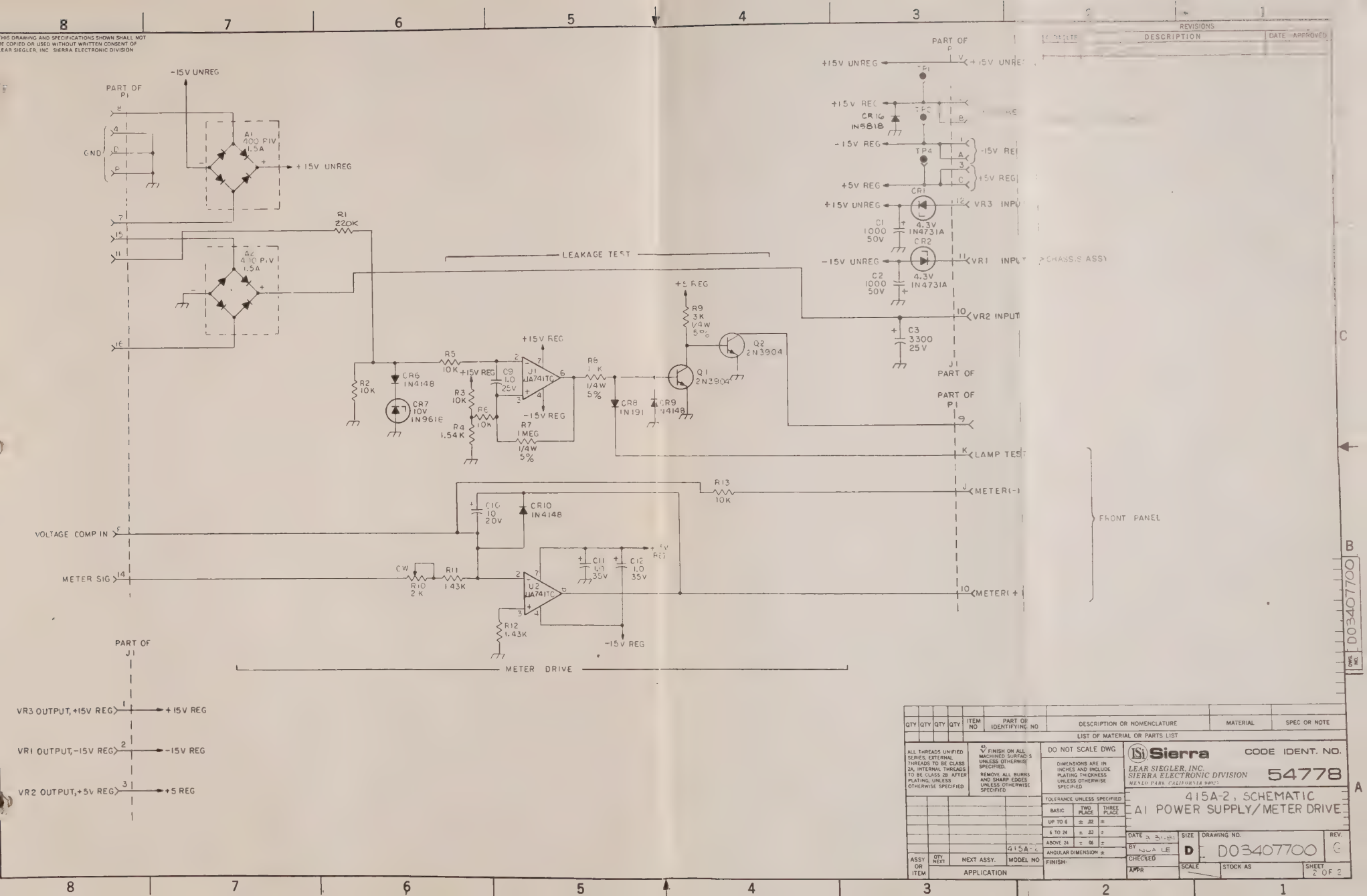
When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

Parts List for 415A-2, A1 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
Q8	SCR 2N6238	910306238
R1	Resistor Comp 220k Ohm 5% 1/2W	905000224
R2	Resistor Fxd Film 10k Ohm 1% 1/8W	907301002
R3	Resistor Fxd Film 10k Ohm 1% 1/8W	907301002
R4	Resistor Met Film 1.54k Ohm 1% 1/8W	907301541
R5	Resistor Fxd Film 10k Ohm 1% 1/8W	907301002
R6	Resistor Fxd Film 10k Ohm 1% 1/8W	907301002
R7	Resistor Comp 1 Meg Ohm 5% 1/4W	906900105
R8	Resistor Comp 10k Ohm 5% 1/4W	906900103
R9	Resistor Fxd Comp 3k Ohm 5% 1/4W	906900302
R10	Potentiometer 2k Ohm 10% 1/2W Multi-turn	907920202
R11	Resistor Metal Film 1.43k Ohm 1% 1/8W	907301431
R12	Resistor Metal Film 1.43k Ohm 1% 1/8W	907301431
R13	Resistor Fxd Film 10k Ohm 1% 1/8W	907301002
R14	Resistor Metal Film 7.15k Ohm 1% 1/8W	907307151
R15	Resistor Metal Film 4.99k Ohm 1% 1/8W	907304991
R16	Resistor Metal Film 301 Ohm 1% 1/8W	907303010
R17	Resistor Metal Film 4.99k Ohm 1% 1/8W	907304991
R18	Resistor Metal Film 1.91k Ohm 1% 1/8W	907301911
R19	Resistor Metal Film 8.87k Ohm 1% 1/8W	907308871
R20	Resistor Fxd, Film 1.0k Ohm 1% 1/8W	907301001
R21	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R22	Resistor Comp 20.0k Ohm 1% 1/8W	007302002
R23	Resistor Comp 2.2k Ohm 5% 1W	905400222
R24	Resistor Fxd Comp 5.1k Ohm 5% 1/4W	906900512
R25	Resistor Prec 2.99 Ohm 1% 1/2W	906100071
R26	Resistor Metal Film 7.50k Ohm 1% 1/8W	907307501
R27	Potentiometer 2k Ohm 10% 1/2W Multi-turn	907920202
R28	Resistor Metal Film 16.9k Ohm 1% 1/8W	907301692
R29	Resistor Comp 680 Ohm 5% 1/2W	905000681
R30	Resistor Metal Film 301 Ohm 1% 1/8W	907303010
R31	Resistor Comp 680 Ohm 5% 1/2W	905000681
R32	Resistor Comp 1 Meg Ohm 5% 1/4W	906900105
R33	Resistor Comp 150k Ohm 5% 1/4W	906900154
R34	Resistor 30k Ohm 5% 1/4W	906900303
R35	Resistor 6.2k 5% 1/4W	906900622
R36	Resistor Comp 15k Ohm 5% 1/4W	906900153
R37	Resistor Comp 680 Ohm 5% 1/2W	905000681
R38	Resistor 100k Ohm 5% 1/4W	906900104
R39	Resistor 220k Ohm 5% 1/2W	905000224
R40	Resistor 1k Ohm 5% 1/4W	906900102
R41	Resistor 680 Ohm 5% 1/4W	906900681
U1	IC LM741TC	920310741
U2	IC LM741TC	920310741
U3	IC LM324N Quad Operational Amp	920300324
U4	IC LM308	920300308
U5	IC 4N28	920300428

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

THIS DRAWING AND SPECIFICATIONS SHOWN SHALL NOT BE COPIED OR USED WITHOUT WRITTEN CONSENT OF LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION



REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

QTY	QTY	QTY	QTY	ITEM NO	PART OR IDENTIFYING NO	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE

LIST OF MATERIAL OR PARTS LIST

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B AFTER PLATING, UNLESS OTHERWISE SPECIFIED

FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED

DO NOT SCALE DWG. DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .02	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION ±		

FINISH:

Sierra — LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION MENLO PARK, CALIFORNIA 94025

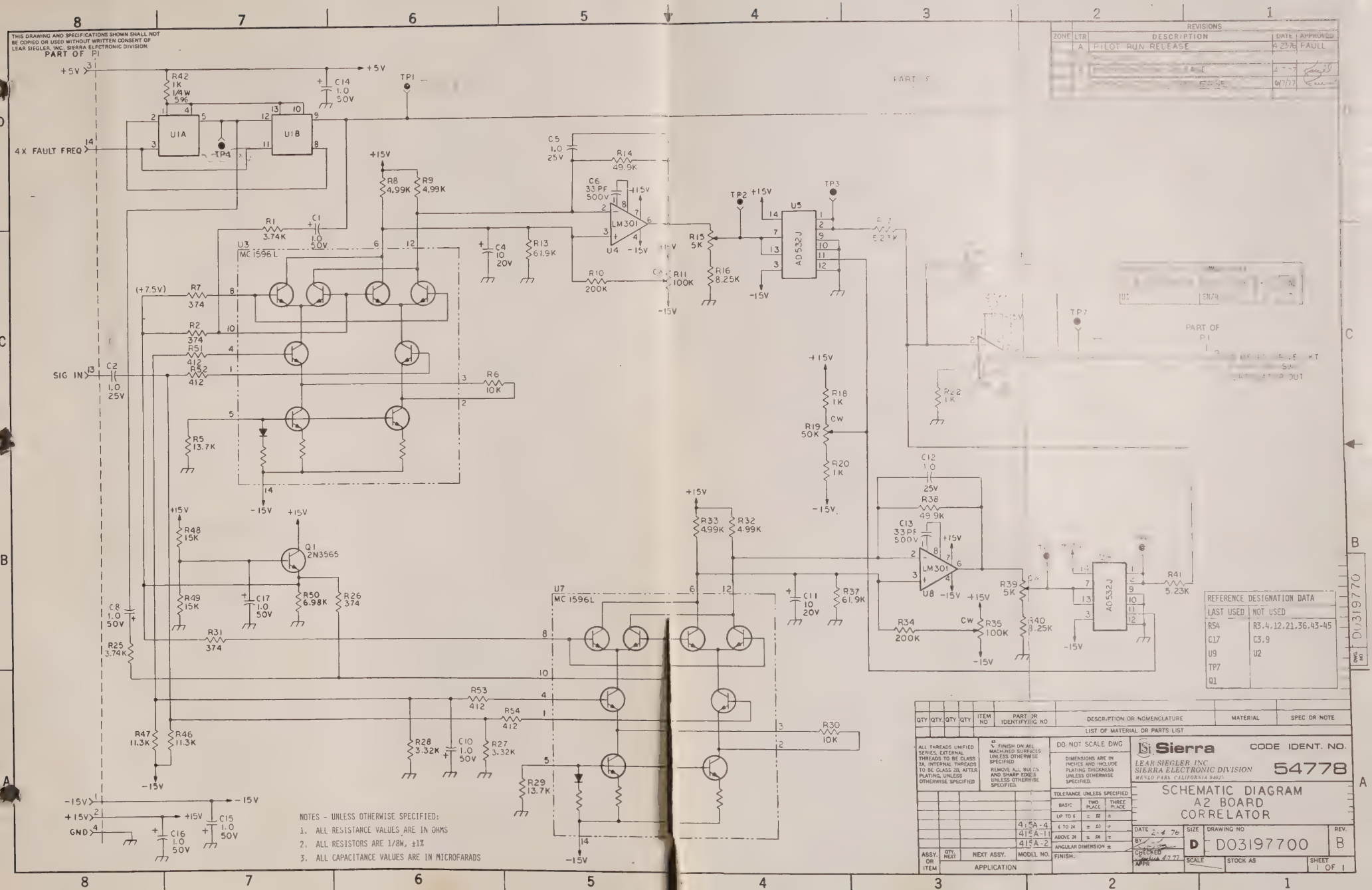
CODE IDENT. NO. 54778

415A-2, SCHEMATIC A1 POWER SUPPLY/METER DRIVE

ASSY OR ITEM	QTY NEXT	NEXT ASSY.	MODEL NO
		APPLICATION	415A-2

DATE	SIZE	DRAWING NO.	REV.
2-31-81	D	D03407700	G
BY NJA LE			
CHECKED			
APPR	SCALE	STOCK AS	SHEET 2 OF 2

D03407700


THIS DRAWING AND SPECIFICATIONS SHOWN SHALL NOT BE COPIED OR USED WITHOUT WRITTEN CONSENT OF LEAR SIEGLER, INC., SIERRA ELECTRONIC DIVISION.
PART OF P1
+5V
R42 1K 1/4W 5%
C14 1.0 50V
TP1
U1A
U1B
TP4
4X FAULT FREQ
SIG IN
C2 1.0 25V
R1 3.74K
C1 1.0 50V
U3 MC1596L
R7 374
R2 374
R51 412
R52 412
R6 10K
R5 13.7K
(+7.5V)
+15V
-15V
R8 4.99K
R9 4.99K
C5 1.0 25V
R14 49.9K
C6 33PF 500V
U4 LM301
C4 10 20V
R13 61.9K
R10 200K
R11 100K
R15 5K
R16 8.25K
TP2
TP3
U5 AD532J
R17 5.23K
R22 1K
TP7
R18 1K
R19 50K CW
R20 1K
C12 1.0 25V
R38 49.9K
C13 33PF 500V
U8 LM301
R39 5K CW
R40 8.25K
R41 5.23K
R34 200K
R35 100K CW
R48 15K
R49 15K
Q1 2N3565
C17 1.0 50V
R50 6.98K
R26 374
C8 1.0 50V
R25 3.74K
R31 374
U7 MC1596L
C11 10 20V
R37 61.9K
R33 4.99K
R32 4.99K
R53 412
R54 412
R47 11.3K
R46 11.3K
R28 3.32K
C10 1.0 50V
R27 3.32K
R29 13.7K
R30 10K
-15V
+15V
GND
C16 1.0 50V
C15 1.0 50V
NOTES - UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL RESISTORS ARE 1/8W, ±1%
3. ALL CAPACITANCE VALUES ARE IN MICROFARADS
REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
A PILOT RUN RELEASE 4-23-76 FAULL
REFERENCE DESIGNATION DATA
LAST USED NOT USED
R54 R3,4,12,21,36,43-45
C17 C3,9
U9 U2
TP7
Q1
QTY QTY QTY QTY ITEM NO PART OR IDENTIFYING NO DESCRIPTION OR NOMENCLATURE MATERIAL SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST
ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED
FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DWG
DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.
TOLERANCE UNLESS SPECIFIED
BASIC TWO PLACE THREE PLACE
UP TO 6 ± .02 ±
6 TO 24 ± .01 ±
ABOVE 24 ± .06 ±
ANGULAR DIMENSION ±
FINISH
Sierra
LEAR SIEGLER INC
SIERRA ELECTRONIC DIVISION
MENLO PARK, CALIFORNIA 94025
CODE IDENT. NO. 54778
SCHEMATIC DIAGRAM
A2 BOARD
CORRELATOR
DATE 2-4-76
BY
CHECKED
APPR
SIZE D
DRAWING NO D0319770
REV. B
SCALE
STOCK AS
SHEET 1 OF 1
ASSY. OR ITEM
QTY. NEXT ASSY.
NEXT ASSY.
MODEL NO.
APPLICATION
4155A-4
4155A-1
4155A-2
D0319770

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A2 PCB	Power Board Assembly for 415A-2	A03149300
C1	Capacitor Tantalum 1.0 uF 50V	902760105
C2	Capacitor Plastic 1.0 uF 25V	903300105
C4	Capacitor Tantalum 10 uF 10% 20V	902720106
C5	Capacitor Plastic 1.0 uF 25V	903300105
C6	Capacitor Dipped Mica 33 pF 2% 500V	901900330
C7	Capacitor Dipped Mica 33 pF 2% 500V	901900330
C8	Capacitor Tantalum 1.0 uF 50V	902760105
C10	Capacitor Tantalum 1.0 uF 50V	902760105
C11	Capacitor Tantalum 10 uF 10% 20V	902720106
C12	Capacitor Plastic 1.0 uF 25V	903300105
C13	Capacitor Dipped Mica 33 pF 2% 500V	901900330
C14	Capacitor Tantalum 1.0 uF 50V	902760105
C15	Capacitor Tantalum 1.0 uF 50V	902760105
C16	Capacitor Tantalum 1.0 uF 50V	902760105
C17	Capacitor Tantalum 1.0 uF 50V	902760105
Q1	Transistor SI 2N3565 NPN	910303565
R1	Resistor Metal Film 3.74k Ohm 1% 1/8W	907303741
R2	Resistor Metal Film 374 Ohm 1% 1/8W	907303740
R5	Resistor Metal Film 13.7k Ohm 1% 1/8W	907301372
R6	Resistor Fxd Film 10k Ohm 1% 1/8W	907301002
R7	Resistor Metal Film 374 Ohm 1% 1/8W	907303740
R8	Resistor Metal Film 4.99k Ohm 1% 1/8W	907304991
R9	Resistor Metal Film 4.99k Ohm 1% 1/8W	907304991
R10	Resistor Metal Film 200k Ohm 1% 1/8W	907302003
R11	Potentiometer 100k Ohm 10% 15 Turn	907900279
R13	Resistor Metal Film 61.9k Ohm 1% 1/8W	907306192
R14	Resistor Metal Film 49.9k Ohm 1% 1/8W	907304992
R15	Potentiometer 50k Ohm 10% 15 Turn	907900338
R16	Resistor Comp 8.25k Ohm 1% 1/8W	907308251
R17	Resistor Metal Film 5.23k Ohm 1% 1/8W	907305231
R18	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R19	Potentiometer 50k Ohm 10% 15 Turn	907900338
R20	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R22	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R23	Potentiometer 2k Ohm 10% 15 Turn	907900288
R24	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R25	Resistor Metal Film 3.74k Ohm 1% 1/8W	907303741
R26	Resistor Metal Film 374 Ohm 1% 1/8W	907303740
R27	Resistor Metal Film 3.32k Ohm 1% 1/8W	907303321
R28	Resistor Metal Film 3.32k Ohm 1% 1/8W	907303321
R29	Resistor Metal Film 13.7k Ohm 1% 1/8W	907301372
R30	Resistor Fxd Film 10k Ohm 1% 1/8W	907301002
R31	Resistor Metal Film 374 Ohm 1% 1/8W	907303740
R32	Resistor Metal Film 4.99k Ohm 1% 1/8W	907304991

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

Parts List for 415A-2, A2 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
R33	Resistor Metal Film 4.99k Ohm 1% 1/8W	907304991
R34	Resistor Metal Film 200k Ohm 1% 1/8W	907302003
R35	Potentiometer 100k Ohm 10% 15 Turn	907900279
R37	Resistor Metal Film 61.9 k Ohm 1% 1/8W	907306192
R38	Resistor Metal Film 49.9k Ohm 1% 1/8W	907304992
R39	Potentiometer 5k Ohm 10% 15 Turn	907900316
R40	Resistor Comp 8.25k Ohm 1% 1/8W	907308251
R41	Resistor Metal Film 5.23k Ohm 1% 1/8W	907305231
R42	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R46	Resistor Metal Film 11.3k Ohm 1% 1/8W	907301132
R47	Resistor Metal Film 11.3k Ohm 1% 1/8W	907301132
R48	Resistor Fxd Film 15.0k Ohm 1% 1/8W	907301502
R49	Resistor Fxd Film 15.0k Ohm 1% 1/8W	907301502
R50	Resistor Metal Film 6.98k Ohm 1% 1/8W	907306981
R51	Resistor Metal Film 412 Ohm 1% 1/8W	907304120
R52	Resistor Metal Film 412 Ohm 1% 1/8W	907304120
R53	Resistor Metal Film 412 Ohm 1% 1/8W	907304120
R54	Resistor Metal Film 412 Ohm 1% 1/8W	907304120
U1	IC SN74LS74 Dual Flip-Flop	920317474
U3	IC MC1596L Modulator-Demodulator	920301596
U4	IC LM301AN Operational Amp	920300301
U5	IC AD532JD Multiplier Decoder	920300532
U6	IC LM301AN Operational Amp	920300301
U7	IC MC1596L Modulator-Demodulator	920301596
U8	IC LM301AN Operational Amp	920300301
U9	IC AD532JD Multiplier Decoder	920300532

When given, manufacturer's part numbers are only to aid identification.
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ZONE	LTR	DESCRIPTION	DATE	APP'D
	A	PILOT		
	A2	PCO UPDATE	12/1298	
	A3	PCO 1338		
	A4	PCO 1667		
	A5	PCO 1869		
	B	EPR		
		PRODUCTION RELEASE		
	C	ECO #1671	A 5	
	C1	ECO 1686 V2	DB	
	D			
	E			

PART OF P1

+5V, +15V, GND

C7 22 15V; C8 0.1 50V; C12 0.1 50V; C13 0.1 50V; C14 0.1 50V; C16 0.1 50V

C10 1.0 35V; C11 0.1 50V

TO FRONT PANEL PCM IN

C1 0.1 50V; T1; R7 330 1/4W 5%; R1 160 1/4W 5%; R11 160 1/4W 5%; C2 1.0 35V

U5

TP1, TP2, TP3, TP4, TP5

U9A, U9B

R4 1K; R5 1 MEG 1/4W 5%; R8 1K; R9 1 MEG 1/4W 5%

C3 1.0 25V

CR6, CR7, CR8

R15 6.04K; R16 1.05K; R2 200; R13 3.4K; R12 40.2K; C4 1.0 35V; 15Ω

AMI ERRORS

U10D, U10C, U10B, U10A, U11A

U14B, U14A

R17 1K 1/4W 5%

U13A, U11C, U13B

C5 22PF 500V; R19 1K 1/4W 5%; R20 73.2K

C6 1.0 35V; R21 68.1K

CR10 IN3666

R23 1K .4W 5%

U13D

SEE SHEET 2

(1 SC LINE) C

(PULSES) D

A, B, E, F

INTEGRATED CIRCUIT SUMMARY DATA			
IC REF DESIGNATION	DEVICE TYPE	+5V	GND
U1, 10,11	SN74LS00	14	7
U2	SN74LS193	16	8
U3	SN74LS04	14	7
U4, 12	SN74LS10	14	7
U5 (16 PIN DIP DIODE ARRAY)	FSA2719M		
U 14	SN74LS73	4	11
U9	LM319N		
U13,16	96L02	16	8
U15	SN75492	11	4

REFERENCE DESIGNATION DA A	
LAST USED	NOT USED
R34	R3,14,37
C16	
U16	U6,7,8
CR10	CR9
T1	
TP7	

NOTES - UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTANCE VALUES ARE IN OHMS.
2. ALL RESISTORS ARE 1/8W, ±1%
3. ALL CAPACITANCE VALUES ARE IN MICROFARADS
4. ALL DIODES ARE 1N4148

QTY	QTY	QTY	QTY	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE

LIST OF MATERIAL OR PARTS LIST

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B AFTER PLATING, UNLESS OTHERWISE SPECIFIED

FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED

DO NOT SCALE DWG.

DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .02	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION ±		

FINISH:

Sierra — LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION

CODE IDENT. NO. 54778

A3 ERROR DETECTOR

DATE	SIZE	DRAWING NO.	REV.
2/13/77	D	D03197800	D

BY; CHECKED; APPR

SCALE; STOCK AS; SHEET 1 OF 2

ASSY. OR ITEM	QTY. NEXT	NEXT ASSY.	MODEL NO.
	REF	415A-2	
APPLICATION			

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A3 PCB	Power Board Assembly for 415A-2	A03149500
C1	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C2	Capacitor Tantalum 1 uF 10% 35V	902740105
C3	Capacitor Plastic 1.0 uF 25V	903300105
C4	Capacitor Tantalum 1 uF 10% 35V	902740105
C5	Capacitor Dipped Mica 82 pF 2% 500V	901900820
C6	Capacitor Tantalum 1 uF 10% 35V	902740105
C7	Capacitor Tantalum 22 uF 20% 15V	902740226
C8	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C9	Capacitor Tantalum 1 uF 10% 35V	902740105
C10	Capacitor Tantalum 1 uF 10% 35V	902740105
C11	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C12	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C13	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C14	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C15	Capacitor Dipped Mica 150 pF 5% 500V	901900151
C16	Capacitor Ceramic 0.1 uF 20% 50V	901300104
CR 01	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR 02	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR 03	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR 04	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR 05	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR 06	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR 07	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR 08	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR 10	Diode GE 1N3666 80V 200 mA 75 mW	910503666
R1	Resistor Fxd Comp 160 Ohm 5% 1/4W	906900161
R2	Resistor Metal Film 200 Ohm 1% 1/8W	907302000
R4	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R5	Resistor Comp 1 Meg Ohm 5% 1/4W	906900105
R6	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R7	Resistor Fxc Comp 330 Ohm 5% 1/4W	906900331
R8	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R9	Resistor Comp 1 Meg Ohm 5% 1/4W	906900105
R10	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R11	Resistor Fxd Comp 160 Ohm 5% 1/4W	906900161
R12	Resistor Metal Film 40.2k Ohm 1% 1/8W	907304022
R13	Resistor Metal Film 3.40k Ohm 1% 1/8W	907303401
R15	Resistor Metal Film 6.04k Ohm 1% 1/8W	907306041
R16	Resistor Metal Film 1.05k Ohm 1% 1/8W	907301051
R17	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R18	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R19	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R20	Resistor Metal Film 73.2k Ohm 1% 1/8W	907307322
R21	Resistor Metal Film 68.1k Ohm 1% 1/8W	907306812

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

Parts List for 415A-2, A3 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
R22	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R23	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R24	Resistor Metal Film 150k Ohm 1% 1/8W	907301503
R25	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R26	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R27	Resistor Fxd Comp 22 Ohm 5% 1/4W	906900220
R28	Resistor Fxd Comp 22 Ohm 5% 1/4W	906900220
R29	Resistor Fxd Comp 22 Ohm 5% 1/4W	906900220
R30	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R31	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R32	Resistor Comp 680 Ohm 5% 1/4W	906900681
R33	Resistor Fxd Comp 51 Ohm 5% 1/4W	906900510
R34	Resistor Metal Film 82.5k Ohm 1% 1/8W	907308252
T1	Transformer Toroidal 6 MH 20% CTI to ICT	909300013
U1	IC SN74LS00N Quad 2 Input Nand Gate	920327400
U2	IC SN74LS193N Counter	920384193
U3	IC SN74LS04N Hex Inverter	920327404
U4	IC SN74LS10N Triple 3 Input Nand Gate	920327410
U5	IC FSA2719M Diode Array	920302719
U6	IC SN74LS00N Quad 2 Input Nand Gate	920327400
U7	IC SN74LS75N Dual J-K Flip-Flop	920317473
U8	IC SN74LS10N Triple 3 Input Nand Gate	920327410
U9	IC LM319N Dual Comparator High Speed	920300319
U10	IC SN74LS00N Quad 2 Input Nand Gate	920327400
U11	IC SN74LS00N Quad 2 Input Nand Gate	920327400
U12	IC SN74LS10N Triple 3 Input Nand Gate	920327410
U13	IC 96L02PC Dual Flip-Flop	920309602
U14	IC SN74LS73N Dual J-K Flip-Flop	920317473
U15	IC SN75492PC Mos to Vled Driver	920375492
U16	IC 96L02PC Dual Flip-Flop	920309602

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

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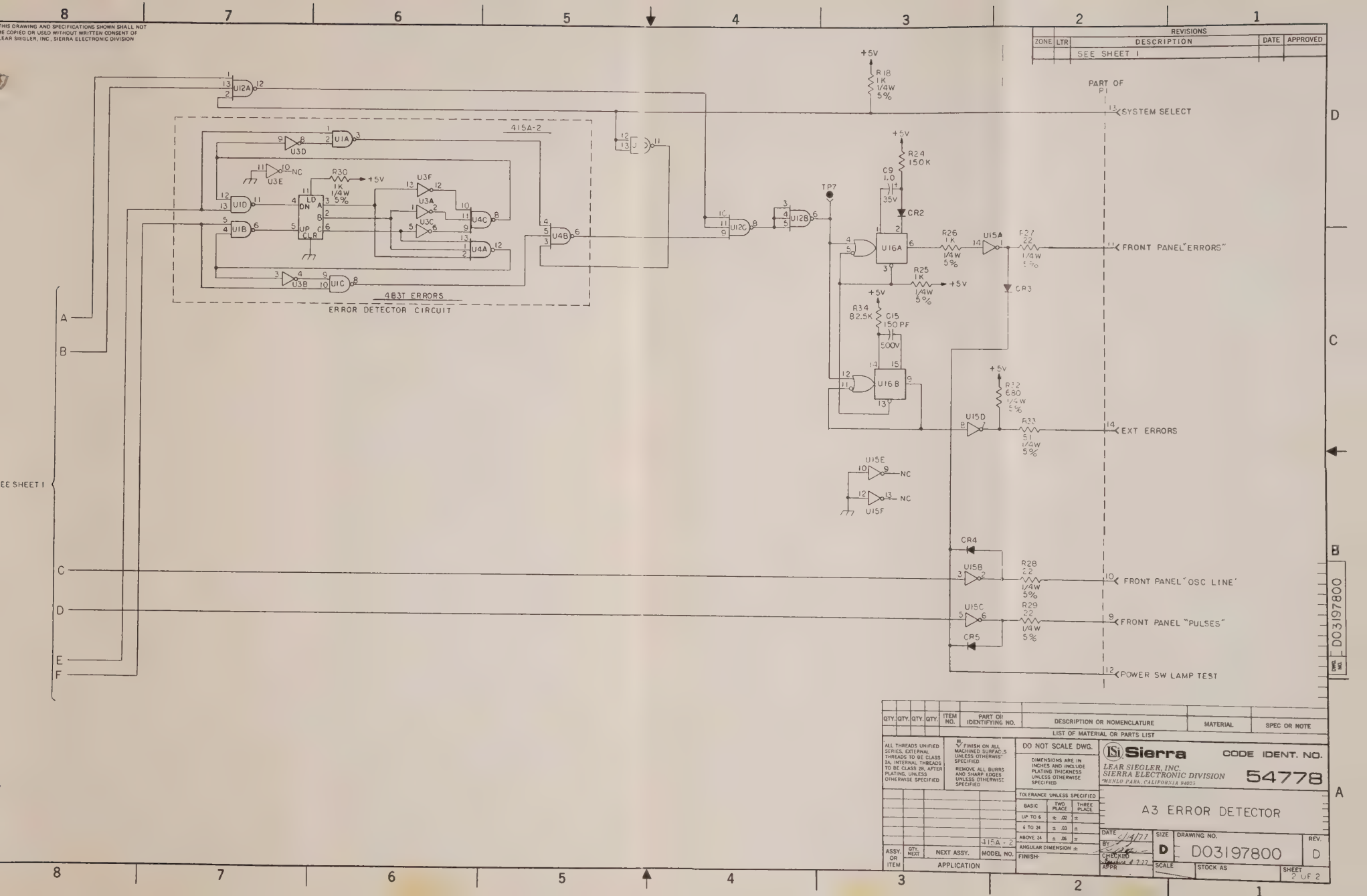
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1		



QTY.	QTY.	QTY.	QTY.	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
					415A-2			

LIST OF MATERIAL OR PARTS LIST

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED

FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED

DO NOT SCALE DWG.

DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .02	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION ±		

FINISH:

ASSY. OR ITEM | QTY. NEXT | NEXT ASSY. | MODEL NO.

APPLICATION

Sierra

LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION
*MENLO PARK, CALIFORNIA 94025

CODE IDENT. NO. 54778

A3 ERROR DETECTOR

DATE	BY	CHECKED	APPR	SIZE	DRAWING NO.	REV.
2/14/77				D	D03197800	D

SCALE | STOCK AS | SHEET 2 OF 2

DWG. NO. D03197800

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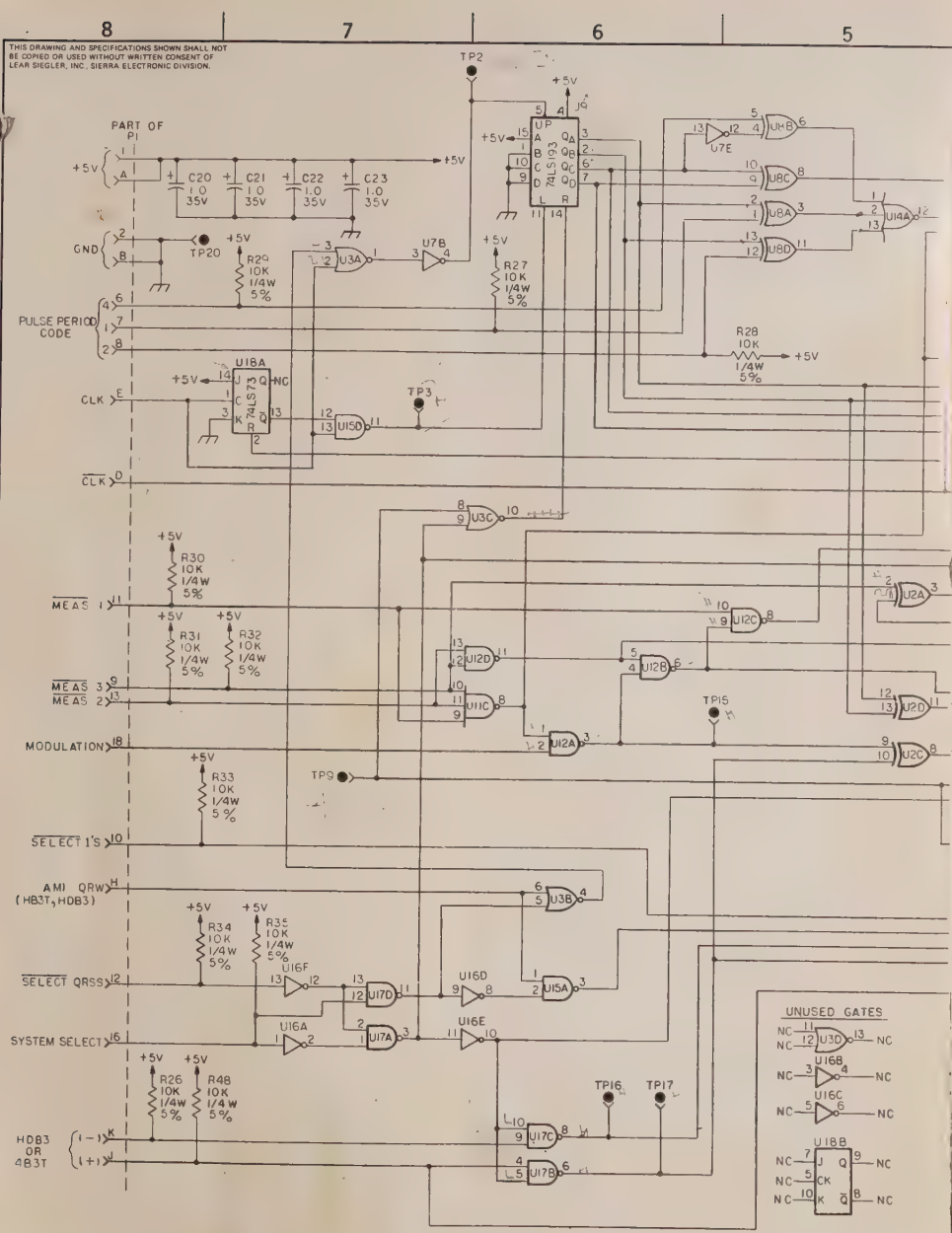

REVISIONS					
ZONE	LTR	DESCRIPTION		DATE	APPROVED
	A	PILOT RUN RELEASE		9-27-76	PAULL
	A1	PCO UPDATE 1270		2-5-76	B.CARLSON
	A4	PCO 1360, 1407, 1586	RAM	8-5-76	MLD
	A5	PCO 1878			
	B	PREPRODUCTION RELEASE		4/17/77	Paull
		PRODUCTION RELEASE		6/7/77	Paull
	C	ECO 17008		2-7-78	
	D	ECO 17660		2-13-78	
	E	ECO 18316		4-30-78	
	F	ECO 18444	P.O	7-3-83	
	G	ECO 18598	MPH	4/21/83	

NOTES - UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL RESISTORS ARE 1/8W, ±1%
3. ALL CAPACITANCE VALUES ARE IN MICROFARADS

[4] SEE TABLE "A"

TABLE "A"		
COMP	-2	-11
R42	36.5 OHMS	46.4 OHMS
R44	36.5 OHMS	46.4 OHMS

REFERENCE DESIGNATION DATA	
LAST USED	NOT USED
C31	R1-10,13-25,R43
C30	C1-15
Q10	Q1-7
U20	—
TP20	TP1
L1	—
T1	—
A1	—
CR3	—

INTEGRATED CIRCUIT SUMMARY DATA			
IC REF DESIGNATION	DEVICE TYPE	+5V	GND
U1	SN74LS20N	14	7
U2,8	SN74LS86N	14	7
U3	SN74LS02N	14	7
U4,10,12,15,17	SN74LS00N	14	7
U5,6,18	SN74LS73N	4	11
U7,16	SN74LS04N	14	7
U9	SN74LS193N	16	8
U11	SN74LS10N	14	7
U13	SN74LS30N	14	7
U14	SN74LS27N	14	7
U19, U20	AS SHOWN	AS SHOWN	

QTY	QTY	QTY	QTY	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE

LIST OF MATERIAL OR PARTS LIST

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED

FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.

DO NOT SCALE DWG.

DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .02	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION	±	

FINISH

ASSY OR ITEM	QTY NEXT	NEXT ASSY	MODEL NO
			4151-11
		APPLICATION	4151-C

Sierra

LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION
MENLO PARK, CALIFORNIA 94025

CODE IDENT. NO. 54778

SCHEMATIC A4

DATE	SIZE	DRAWING NO.	REV.
11/4/77	D	D03197900	G
BY			
CHECKED 12/14/77	SCALE	STOCK AS	SHEET 1 OF 2
APPR			

DWG. NO. D03197900

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A4 PCB	Power Board Assembly for 415A-2	A03149700
A1	Diode Bridge Assy MDS920A-1 1 Amp 25V	910809201
C16	Capacitor Dipped Mica 82 pF 2% 500V	901900820
C17	Capacitor Tantalum 10 uF 10% 20V	902720106
C18	Capacitor Tantalum 10 uF 10% 20V	902720106
C19	Capacitor Ceramic .05 uF 500V	901400503
C20	Capacitor Tantalum 1 uF 10% 35V	902740105
C21	Capacitor Tantalum 1 uF 10% 35V	902740105
C22	Capacitor Tantalum 1 uF 10% 35V	902740105
C23	Capacitor Tantalum 1 uF 10% 35V	902740105
C25	Capacitor 100 pF 50% 500V	901900101
C26	Capacitor 100 pF 50% 500V	901900101
C27	Capacitor Ceramic 0.1 uF ±20% 50V	901300104
C28	Capacitor Ceramic 0.1 uF ±20% 50V	901300104
C29	Capacitor Ceramic 0.1 uF ±20% 50V	901300104
C30	Capacitor Ceramic 0.1 uF ±20% 50V	901300104
CR 01	Diode Zener 1N3829A 6.8V 5%	910633829
CR 02	Diode 1N4148	910504148
CR 03	Diode 1N4148	910504148
L1	Inductor 56 uH	909000141
Q8	Transistor SI PN4258/2N4258 NPN	910304258
Q9	Transistor SI PN4258/2N4258 NPN	910304258
Q10	Transistor 2N3904	910303904
R11	Resistor Comp 470 Ohm 5% 1/4W	906900471
R12	Resistor Comp 470 Ohm 5% 1/4W	906900471
R26	Resistor Comp 10k Ohm 5% 1/4W	906900103
R27	Resistor Comp 10k Ohm 5% 1/4W	906900103
R28	Resistor Comp 10k Ohm 5% 1/4W	906900103
R29	Resistor Comp 10k Ohm 5% 1/4W	906900103
R30	Resistor Comp 10k Ohm 5% 1/4W	906900103
R31	Resistor Comp 10k Ohm 5% 1/4W	906900103
R32	Resistor Comp 10k Ohm 5% 1/4W	906900103
R33	Resistor Comp 10k Ohm 5% 1/4W	906900103
R34	Resistor Comp 10k Ohm 5% 1/4W	906900103
R35	Resistor Comp 10k Ohm 5% 1/4W	906900103
R36	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R37	Resistor Metal Film 1.82k Ohm 1% 1/8W	907301821
R38	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R39	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R40	Resistor Metal Film 249 Ohm 1% 1/8W	907302490
R41	Resistor Metal Film 249 Ohm 1% 1/8W	907302490
R42	Resistor Metal Film 36.5 Ohm 1% 1/8W	907336R50
R43	Resistor Comp 560 Ohm 5% 1/4W	906900561
R44	Resistor Metal Film 36.5 Ohm 1% 1/8W	907336R50
R45	Resistor Fxd Film 5.9 Ohm 1% 1/8W	907305R90

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

INSTRUMENT REPAIR SERVICE, INC.
1541 Elmhurst Rd.
Elk Grove, IL 60007
(312) 439-0141
O/C
DATE REPAIRED
WARRANTY EXPIRES
JOB NO

Parts List for 415A-2, A4 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
R46	Potentiometer 1k 10% 15 Turn PC Mtg	907900290
R47	Resistor Metal Film 1.87k 1% 1/8W	907301871
R48	Resistor Comp 10k Ohm 5% 1/4W	906900103
R50	Resistor Comp 10k Ohm 5% 1/4W	906900103
R51	Resistor Comp 10k Ohm 5% 1/4W	906900103
R52	Resistor Comp 10k Ohm 5% 1/4W	906900103
R56	Resistor WW 5.6 Ohm 5% 2W	906205R60
R57	Resistor WW 5.6 Ohm 5% 2W	906205R60
R58	Resistor Metal Film 1.0k 1% 1/8W	907301001
R59	Resistor Metal Film 1.0k 1% 1/8W	907301001
R60	Resistor 3.9k 5% 1/4W	906900392
R61	Resistor 1k 5% 1/4W	906900102
T1	Transformer w/Electrostatic Shield	909910013
U1	IC SN74LS20N Dual 4 Input Nand Gate	920317420
U2	IC 74LS86PC Quad 2 Input Exclusive or Gate	920317486
U3	IC SN74LS02	920327402
U4	IC SN74LS00N Quad 2 Input Nand Gate	920327400
U5	IC SN74LS75N Dual J-K Flip-Flop	920317473
U6	IC SN74LS75N Dual J-K Flip-Flop	920317473
U7	IC SN74LS04N Hex Inverter	920327404
U8	IC 74LS86PC Quad 2 Input Exclusive or Gate	920317486
U9	IC SN74193N Synchronous Up/Down Counter	920384193
U10	IC SN74LS00N Quad 2 Input Nand Gate	920327400
U11	IC SN74LS10N Triple 3 Input Nand Gate	920327410
U12	IC SN74LS00N Quad 2 Input Nand Gate	920327400
U13	IC 74LS30PC 8 Input Nand Gate	920317430
U14	IC SN74LS27N Dual 4 Input Nand Gate	920317427
U15	IC SN74LS00N Quad 2 Input Nand Gate	920327400
U16	IC SN74LS04N Hex Inverter	920327404
U17	IC SN74LS00N Quad 2 Input Nand Gate	920327400
U18	IC SN74LS75N Dual J-K Flip-Flop	920317473
U19	IC LM723CD Voltage Regulator	920300723
U20	IC SN7416N	920307416

When given, manufacturer's part numbers are only to aid identification.
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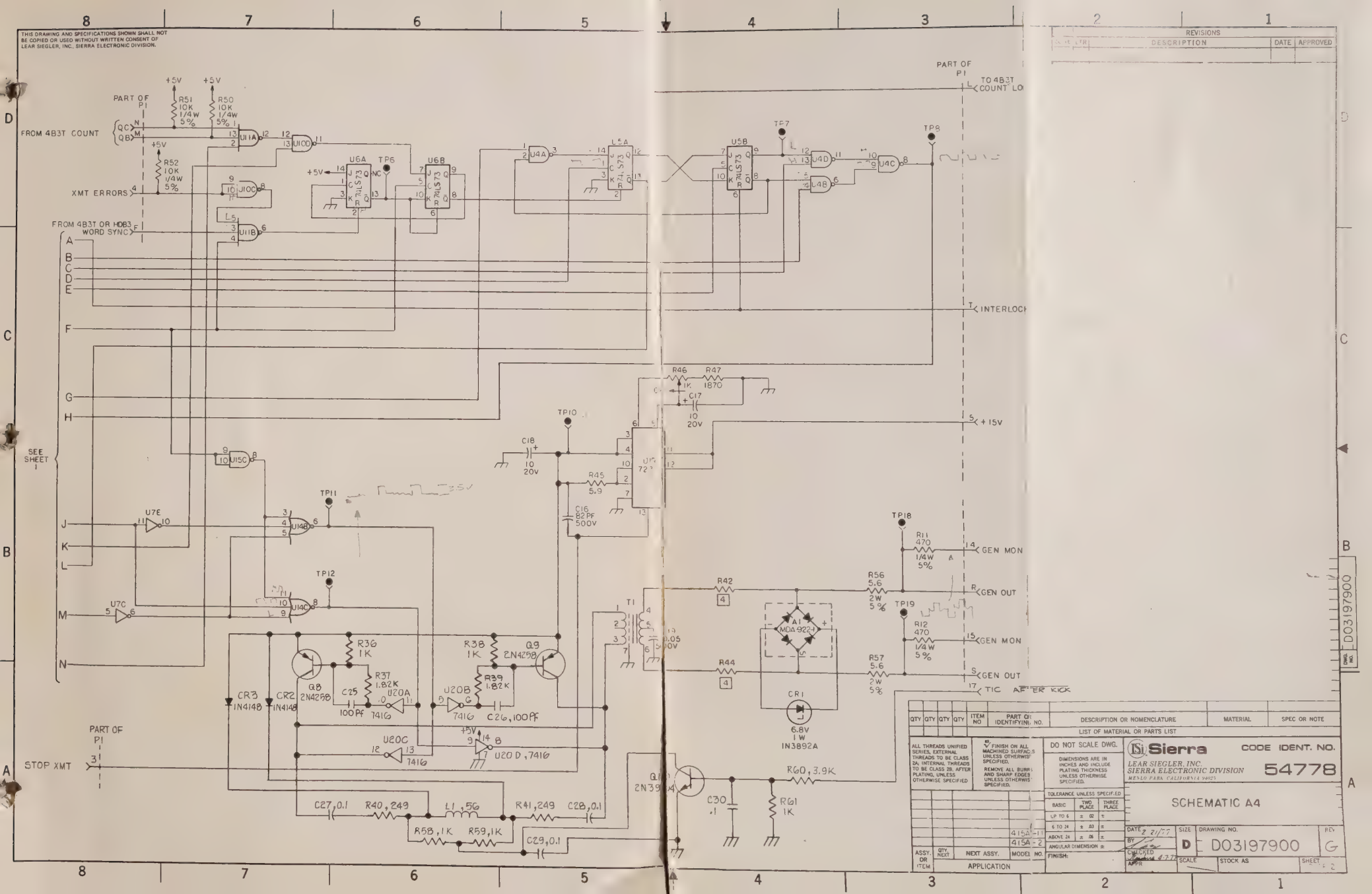


REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

QTY	QTY	QTY	ITEM NO	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE

LIST OF MATERIAL OR PARTS LIST

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED

FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.

DO NOT SCALE DWG. DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .02	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION	±	

FINISH:

ASSY. OR ITEM	QTY. NEXT	NEXT ASSY.	MODEL NO.
		APPLICATION	415A-1 1
			415A-2

Sierra
LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION
MENLO PARK, CALIFORNIA 94025

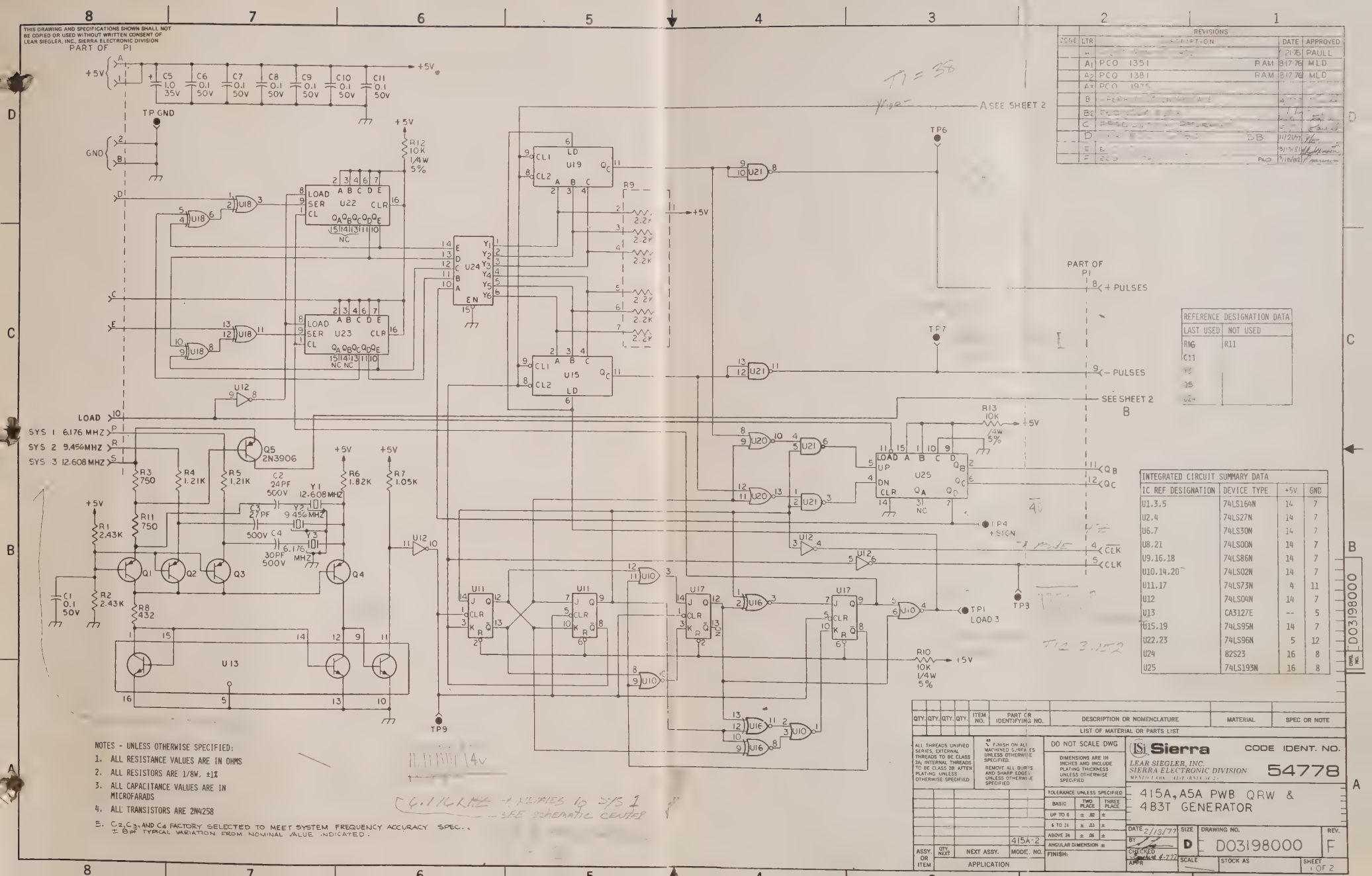
CODE IDENT. NO. 54778

SCHEMATIC A4

DATE	SIZE	DRAWING NO.	REV
2 21 77	D	D03197900	G
BY			
CHECKED			
APPR	SCALE	STOCK AS	SHEET 1 OF 2

DWG NO. D03197900

INSTRUMENT REPAIR SERVICE, INC.
1541 Elmhurst Rd.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PART OF P1
+5V
C5 1.0 35V
C6 0.1 50V
C7 0.1 50V
C8 0.1 50V
C9 0.1 50V
C10 0.1 50V
C11 0.1 50V
TP GND
GND
R12 10K 1/4W 5%
U18
U22
U23
U24
U19
U15
U21
R9 2.2K
SEE SHEET 2
TP6
TP7
PART OF P1
+ PULSES
- PULSES
SEE SHEET 2
LOAD
SYS 1 6.176 MHZ
SYS 2 9.456MHZ
SYS 3 12.608MHZ
Q5 2N3906
R3 750
R4 1.21K
R5 1.21K
R6 1.82K
R7 1.05K
R11 750
R1 2.43K
R2 2.43K
R8 432
C1 0.1 50V
C2 24PF 500V
C3 27PF 500V
C4 30PF 500V
Y1 12.608MHZ
Y2 9.456 MHZ
Y3 6.176 MHZ
Q1
Q2
Q3
Q4
U13
R13 10K 1/4W 5%
U25
TP4 +SIGN
CLK
CLK
TP1 LOAD 3
TP3
R10 10K 1/4W 5%
TP9
NOTES - UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL RESISTORS ARE 1/8W, ±1%
3. ALL CAPACITANCE VALUES ARE IN MICROFARADS
4. ALL TRANSISTORS ARE 2N4258
5. C2, C3, AND C4 FACTORY SELECTED TO MEET SYSTEM FREQUENCY ACCURACY SPEC.. ± 8pF TYPICAL VARIATION FROM NOMINAL VALUE INDICATED.
REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
A1 PCO 1351 RAM 8-17-76 MLD
A2 PCO 1381 RAM 8-17-76 MLD
A3 PCO 1975
D DB. 11/12/77
E 8/15/78
F ECO PMD 9/16/82
REFERENCE DESIGNATION DATA
LAST USED NOT USED
R16 R11
C11
INTEGRATED CIRCUIT SUMMARY DATA
IC REF DESIGNATION DEVICE TYPE +5V GND
U1.3.5 74LS164N 14 7
U2.4 74LS27N 14 7
U6.7 74LS30N 14 7
U8.21 74LS00N 14 7
U9.16.18 74LS86N 14 7
U10.14.20 74LS02N 14 7
U11.17 74LS73N 4 11
U12 74LS04N 14 7
U13 CA3127E -- 5
U15.19 74LS95N 14 7
U22.23 74LS96N 5 12
U24 82S23 16 8
U25 74LS193N 16 8
QTY. QTY. QTY. ITEM NO. PART OR IDENTIFYING NO. DESCRIPTION OR NOMENCLATURE MATERIAL SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST
ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B AFTER PLATING UNLESS OTHERWISE SPECIFIED
FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DWG
DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED
TOLERANCE UNLESS SPECIFIED
BASIC TWO PLACE THREE PLACE
UP TO 6 ± .02 ±
6 TO 24 ± .01 ±
ABOVE 24 ± .06 ±
ANGULAR DIMENSION ±
FINISH:
Sierra
LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION
CODE IDENT. NO. 54778
415A, A5A PWB QRW & 483T GENERATOR
415A-2
ASSY. OR ITEM QTY. NEXT NEXT ASSY. MODEL NO.
APPLICATION
DATE 2/13/77
BY
CHECKED
APPR
SIZE D
DRAWING NO. D03198000
REV. F
SCALE
STOCK AS
SHEET 1 OF 2
D03198000

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A5 PCB	Power Board Assembly for 415A-2	A03149900
C1	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C2	Capacitor Mica 24 pF 2% 500 VDCW	901900240
C3	Capacitor Dura Mica 27 pF 2% 500V	901910270
C4	Capacitor Dipped Mica 30 pF 2% 500V	901900300
C5	Capacitor Tantalum 1 uF 10% 35V	902740105
C6	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C7	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C8	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C9	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C10	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C11	Capacitor Ceramic 0.1 uF 20% 50V	901300104
Q1	Transistor SI PN4258/2N4258 NPN	910304258
Q2	Transistor SI PN4258/2N4258 NPN	910304258
Q3	Transistor SI PN4258/2N4258 NPN	910304258
Q4	Transistor SI PN4258/2N4258 NPN	910304258
Q5	Transistor SI 2N3906 PNP	910303906
R1	Resistor Fax Film 2.43k Ohm 1% 1/8W	907302431
R2	Resistor Fax Film 2.43k Ohm 1% 1/8W	907302431
R3	Resistor Metal Film 750 Ohm 1% 1/8W	907307500
R4	Resistor Metal Film 1.21k Ohm 1% 1/8W	907301211
R5	Resistor Metal Film 1.21k Ohm 1% 1/8W	907301211
R6	Resistor Fxd Film 1.82k Ohm 1% 1/8W	907301821
R7	Resistor Metal Film 1.05k Ohm 1% 1/8W	907301051
R8	Resistor Fxd Film 432 Ohm 1% 1/8W	907304320
R9	Resistor Com Junc Network 2.2k Ohm 2% 0.2W	920680222
R10	Resistor Comp 10k Ohm 5% 1/4W	906900103
R11	Resistor Metal Film 750 Ohm 1% 1/8W	907307500
R12	Resistor Comp 10k Ohm 5% 1/4W	906900103
R13	Resistor Comp 10k Ohm 5% 1/4W	906900103
R14	Resistor Comp 10k Ohm 5% 1/4W	906900103
R15	Resistor Comp 10k Ohm 5% 1/4W	906900103
R16	Resistor Metal Film 1.05k Ohm 1% 1/8W	907301051
U1	IC 74LS164PC 8 Bit Out Shift Register	920374164
U2	IC SN74LS27N Dual 4 Input Nand Gate	920317427
U3	IC 74LS164PC 8 Bit Out Shift Register	920374164
U4	IC SN74LS27N Dual 4 Input Nand Gate	920317427
U5	IC 74LS164PC 8 Bit Out Shift Register	920374164
U6	IC 74LS30PC 8 Input Nand Gate	920317430
U7	IC 74LS30PC 8 Input Nand Gate	920317430
U8	IC SN74LS00N Quad 2 Input Nand Gate	920327400
U9	IC 74LS86PC Quad 2 Input Exclusive or Gate	920317486
U10	IC SN74LS02N	920327402
U11	IC SN74LS75N Dual J-K Flip-Flop	920317473
U12	IC SN74LS04N Hex Inverter	920327404

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

Parts List for 415A-2, A5 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
U13	IC CA3127E Transistor Array NPN	920303127
U14	IC SN74LS02	920327402
U15	IC 74LS95PC 4 Bit Shift Register	920307495
U16	IC 74LS86PC Quad 2 Input Exclusive or Gate	920317486
U17	IC SN74LS75N Dual J-K Flip-Flop	920317473
U18	IC 74LS86PC Quad 2 Input Exclusive or Gate	920317486
U19	IC 74LS95PC 4 Bit Shift Register	920307495
U20	IC SN74LS02	920327402
U21	IC SN74LS00N Quad 2 Input Nand Gate	920327400
U22	IC SN74LS96 5 Bit Shift Register	920337496
U23	IC SN74LS96 5 Bit Shift Register	920337496
U24	IC 82S23 256 Bit Programmable ROM 32X8 PROM	920308223
U25	IC SN74LS193N Synchronous Up/Down Counter	920384193
XY1	Clip Crystal Holding Steel	921100004
XY2	Clip Crystal Holding Steel	921100004
XY3	Clip Crystal Holding Steel	921100004
Y1	Crystal 12.608 MHz	912200193
Y2	Crystal 9.456 MHz	912200258
Y3	Crystal 6.176 MHz	912200191

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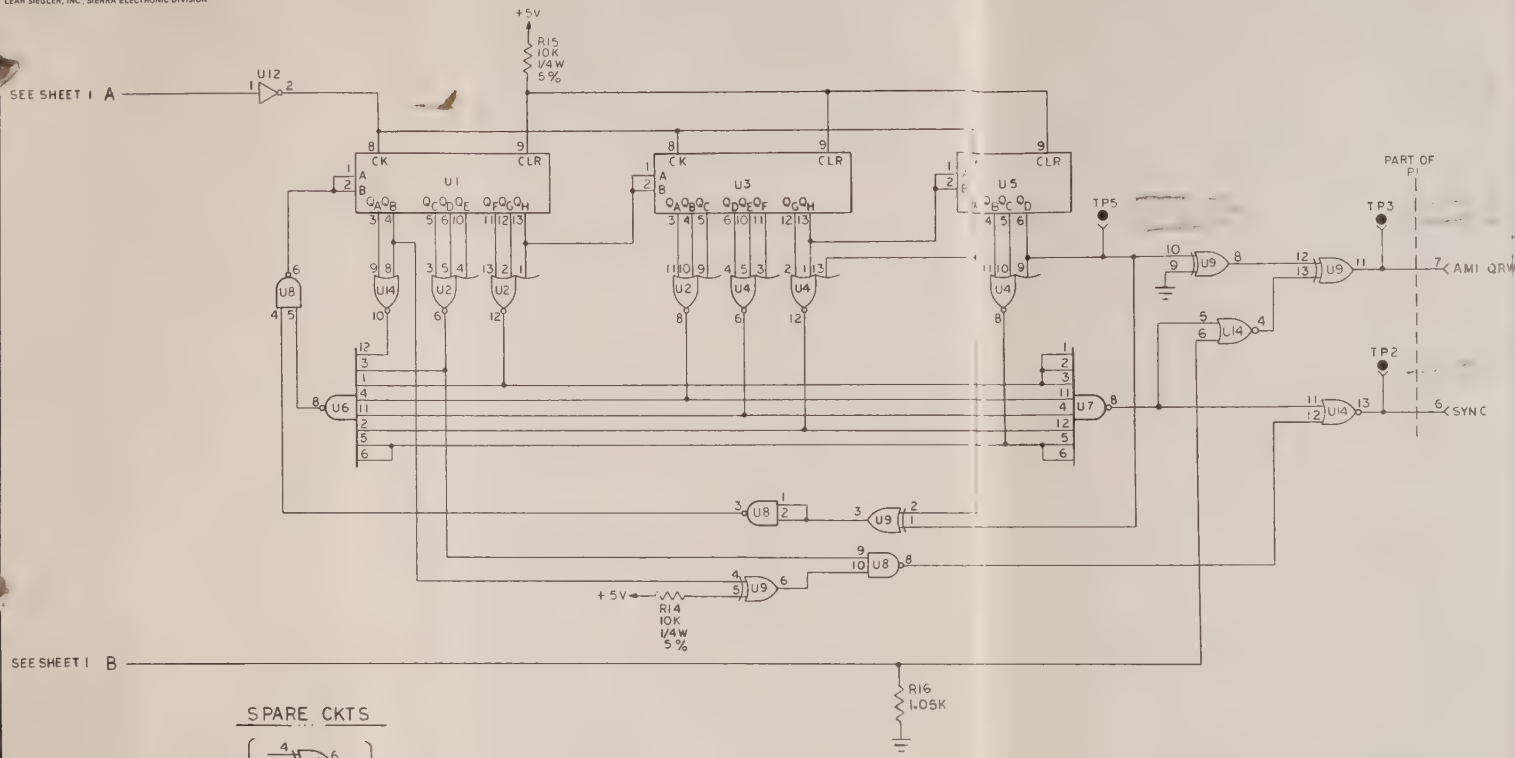
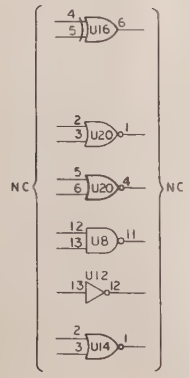
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1		



SPARE CKTS



QTY	QTY	QTY	ITEM NO.	PART OR IDENTIFYING NO	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
					LIST OF MATERIAL OR PARTS LIST		

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED

√ FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.

DO NOT SCALE DWG

DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .02	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION ±		

FINISH

Sierra — LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION, MENLO PARK, CALIFORNIA 94025

CODE IDENT. NO. 54778

415A, A5A PWB QRW & 483T GENERATOR

ASSY OR ITEM	QTY NEXT	NEXT ASSY	MODEL NO
		APPLICATION	415A-2

DATE 2/11/77 BY CHECKED APPR 6-7-77

SIZE D | DRAWING NO. D03198000 | REV. F

SCALE | STOCK AS | SHEET 2 OF 2

DWG NO. D03198000

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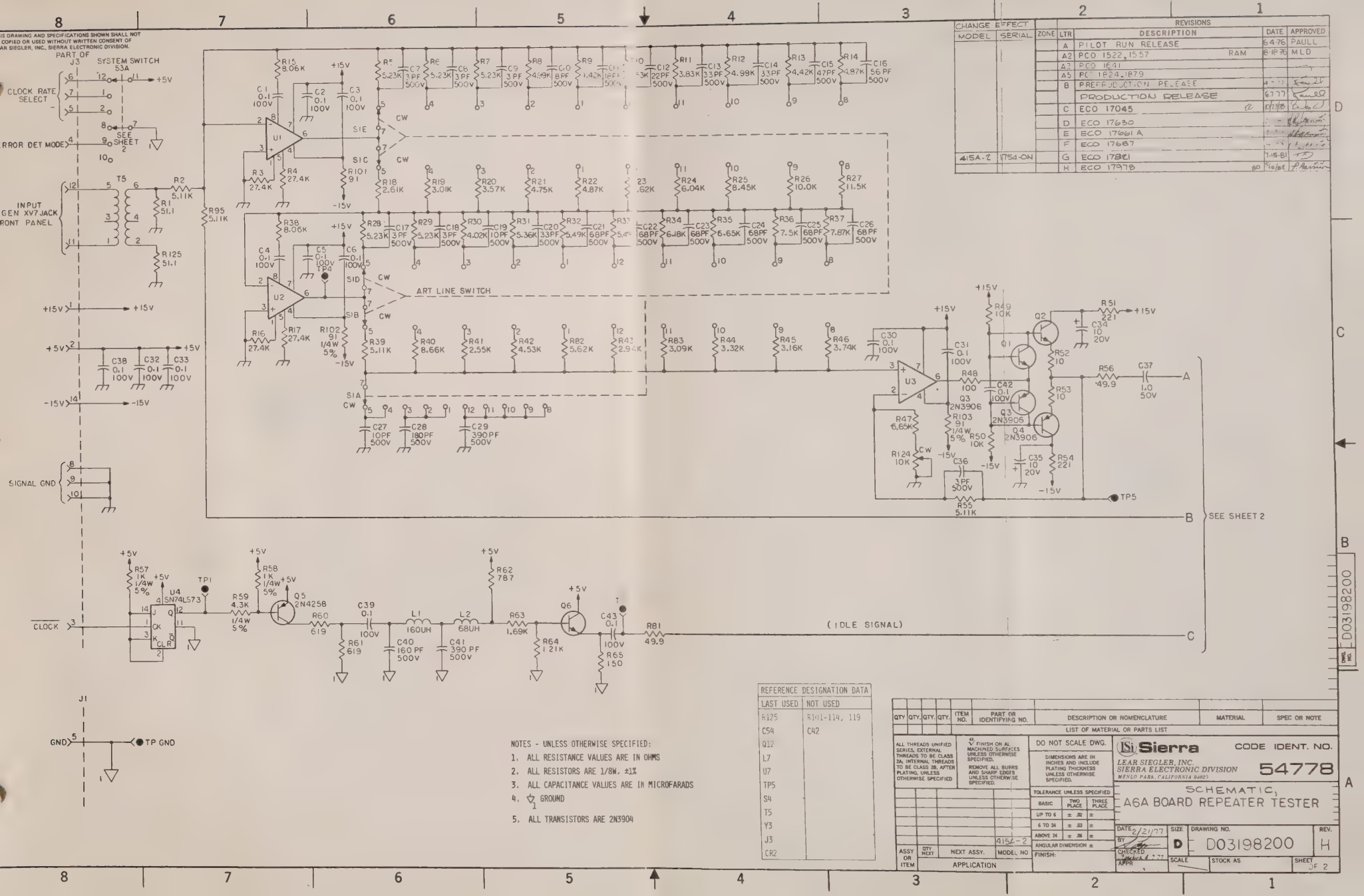
PART OF



CHANGE EFFECT	
MODEL	SERIAL
415A-2	1754-ON

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	PILOT RUN RELEASE	6-4-76	PAULL
	A2	PCO 1522, 1557 RAM	8-18-76	MLD
	A3	PCO 1641		
	A5	PCO 1824, 1879		
	B	PREPRODUCTION RELEASE		
		PRODUCTION RELEASE	6777	
	C	ECO 17045		
	D	ECO 17630		
	E	ECO 17661 A		
	F	ECO 17687		
	G	ECO 17821	7-15-81	
	H	ECO 17978		

REFERENCE DESIGNATION DATA	
LAST USED	NOT USED
R125	R101-114, 119
C54	C42
Q12	
L7	
U7	
TP5	
S4	
T5	
Y3	
J3	
CR2	

NOTES - UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL RESISTORS ARE 1/8W, ±1%
3. ALL CAPACITANCE VALUES ARE IN MICROFARADS
4. ▽1 GROUND
5. ALL TRANSISTORS ARE 2N3904

QTY.	QTY.	QTY.	QTY.	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
						LIST OF MATERIAL OR PARTS LIST		

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED

▽ FINISH ON AL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.

DO NOT SCALE DWG.

DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .01	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION ±		

FINISH:

Sierra
LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION
MENLO PARK, CALIFORNIA 94025

CODE IDENT. NO. 54778

SCHEMATIC,
A6A BOARD REPEATER TESTER

ASSY OR ITEM	QTY. NEXT	NEXT ASSY.	MODEL NO
		APPLICATION	415A-2

DATE 2/21/77 | BY | CHECKED | APPR | SIZE D | DRAWING NO. D03198200 | REV. H | SCALE | STOCK AS | SHEET JF 2

D03198200

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A6 PCB	Power Board Assembly for 415A-2	A03151900
C1	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C2	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C3	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C4	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C5	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C6	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C7	Capacitor Mica 3 pF .5 pF 500 VDCW	901900030
C8	Capacitor Mica 3 pF .5 pF 500 VDCW	901900030
C9	Capacitor Mica 3 pF .5 pF 500 VDCW	901900030
C10	Capacitor Dipped Mica 8 pF 10% 500V	901900080
C11	Capacitor Dipped Mica 18 pF 5% 500V	901900180
C12	Capacitor Dipped Mica 22 pF 5% 500V	901900220
C13	Capacitor Dipped Mica 33 pF 2% 500V	901900330
C14	Capacitor Dipped Mica 33 pF 2% 500V	901900330
C15	Capacitor Dipped Mica 47 pF 5% 500V	901900470
C16	Capacitor Mica 56 pF 5% 500V	901900560
C17	Capacitor Mica 3 pF .5 pF 500 VDCW	901900030
C18	Capacitor Mica 3 pF .5 pF 500 VDCW	901900030
C19	Capacitor Mica 10 pF 5% 500V	901900100
C20	Capacitor Dipped Mica 33 pF 2% 500V	901900330
C21	Capacitor Dipped Mica 68 pF 2% 500V	901900680
C22	Capacitor Dipped Mica 68 pF 2% 500V	901900680
C23	Capacitor Dipped Mica 68 pF 2% 500V	901900680
C24	Capacitor Dipped Mica 68 pF 2% 500V	901900680
C25	Capacitor Dipped Mica 68 pF 2% 500V	901900680
C26	Capacitor Dipped Mica 68 pF 2% 500V	901900680
C27	Capacitor Mica 10 pF 5% 500V	901900100
C28	Capacitor Dipped Mica 180 pF 2% 500V	901910181
C29	Capacitor Dipped Mica 390 pF 2% 500V	901910391
C30	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C31	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C32	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C33	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C34	Capacitor Tantalum 10 uF 10% 20V	902720106
C35	Capacitor Tantalum 10 uF 10% 20V	902720106
C36	Capacitor Mica 3 pF .5 pF 500 VDCW	901900030
C37	Capacitor Mylar 1.0 uF 2% 100V	901100105
C38	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C39	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C40	Capacitor Dipped Mica 160 pF 1% 500V	901900161
C41	Capacitor Dipped Mica 390 pF 5% 500V	901900391
C42	Capacitor Radial Leads 0.1 uF 10% 100V	901220104
C43	Capacitor Radial Leads 0.1 uF 10% 100V	901220104
C44	Capacitor Radial Leads 0.1 uF 10% 100V	901220104

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

Parts List for 415A-2, A6 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
C45	Capacitor Dipped Mica 33 pF 2% 500V	901900330
C46	Capacitor Dipped Mica 33 pF 2% 500V	901900330
C47	Capacitor Dipped Mica 33 pF 2% 500V	901900330
C48	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C49	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C50	Capacitor Dipped Mica 100 pF 2% 500V	901910101
C51	Capacitor Dipped Mica 220 pF 5% 50V	901900221
C52	Capacitor Dipped Mica 100 pF 2% 500V	901910101
C53	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
C54	Capacitor Radial Leads 0.1 uF 10% 100V	901330104
CR 01	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR 02	Diode SI 1N4148 75V 150 mA 500 mW	910504148
J1	Connector PC MTG Wafer Assy Polarizing	914800194
J2	Connector PC MTG Wafer Assy Polarizing	914800193
J3	Socket Dip 14 Pin	914200086
L1	Inductor Fixed Molded 160 uH 5% .22W	909000152
L2	Inductor 68 uH 5% .22W	909000136
L3	Inductor 68 uH 5% .22W	909000136
L4	Inductor 68 uH 5% .22W	909000136
L5	Inductor Encapsulated 100 uH Non	909000103
L6	Inductor Fxd 1000 uH 5% 1/4W	909000155
L7	Inductor Encapsulated 100 uH Non	909000103
Q1	Transistor SI 2N3904 NPN	910303904
Q2	Transistor SI 2N3904 NPN	910303904
Q3	Transistor SI 2N3906 PNP	910303906
Q4	Transistor SI 2N3906 PNP	910303906
Q5	Transistor SI PN4258/2N4258 NPN	910304258
Q6	Transistor SI 2N3904 NPN	910303904
Q7	Transistor SI PN4258/2N4258 NPN	910304258
Q8	Transistor SI PN4258/2N4258 NPN	910304258
Q9	Transistor SI 2N3904 NPN	910303904
Q10	Transistor SI PN4258/2N4258 NPN	910304258
Q11	Transistor SI PN4258/2N4258 NPN	910304258
Q12	Transistor SI 2N3904 NPN	910303904
R1	Resistor Metal Film 51.1 Ohm 1% 1/8W	907351R10
R2	Resistor Metal Film 5.11k Ohm 1% 1/8W	907305111
R3	Resistor Metal Film 27.4k Ohm 1% 1/8W	907302742
R4	Resistor Metal Film 27.4k Ohm 1% 1/8W	907302742
R5	Resistor Metal Film 5.23k Ohm 1% 1/8W	907305231
R6	Resistor Metal Film 5.23k Ohm 1% 1/8W	907305231
R7	Resistor Metal Film 5.23k Ohm 1% 1/8W	907305231
R8	Resistor Metal Film 4.99k Ohm 1% 1/8W	907304991
R9	Resistor Metal Film 4.42k Ohm 1% 1/8W	907304421
R10	Resistor Metal Film 1.53k Ohm 1% 1/8W	907304531
R11	Resistor Metal Film 3.83k Ohm 1% 1/8W	907303831

When given, manufacturer's part numbers are only to aid identification.
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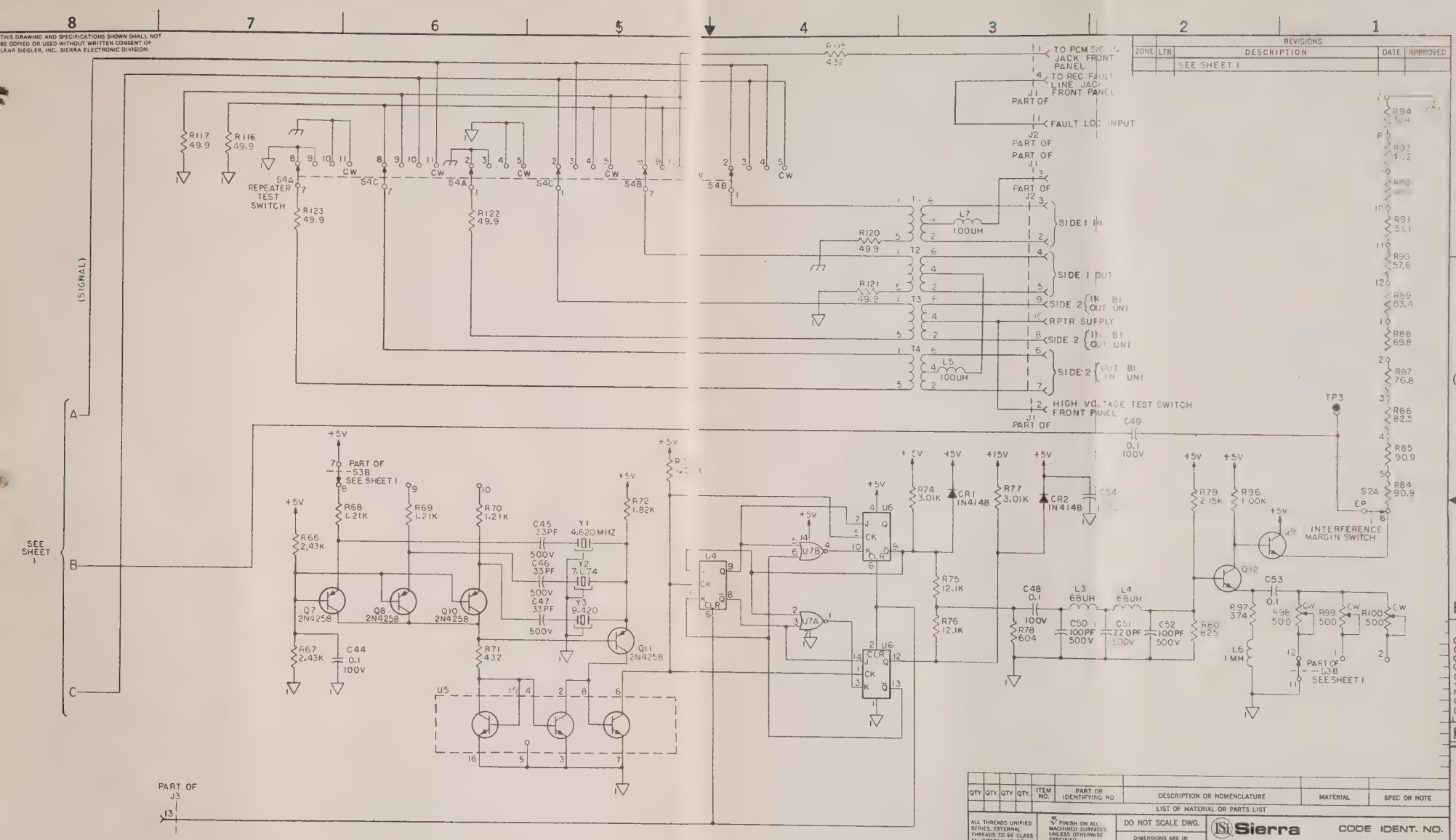

QTY	QTY	QTY	ITEM NO.	PART OR IDENTIFYING NO	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
					LIST OF MATERIAL OR PARTS LIST		

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED

√ FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED

DO NOT SCALE DWG.

DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .01	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION	±	

FINISH:

Sierra

LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION
MENLO PARK, CALIFORNIA 94025

CODE IDENT. NO. 54778

SCHEMATIC, A6A BOARD REPEATER TESTER

ASSY OR ITEM	QTY NEXT	NEXT ASSY.	MODEL NO
		APPLICATION	4154-2

DATE 2/26/77
BY
CHECKED 4-7-77
APPR

SIZE D | DRAWING NO. D03198200 | REV. H

SCALE | STOCK AS | SHEET 2 OF 2

DWG NO. D03198200

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
R12	Resistor Metal Film 4.99k Ohm 1% 1/8W	907304991
R13	Resistor Metal Film 4.42k Ohm 1% 1/8W	907304421
R14	Resistor Metal Film 4.87k Ohm 1% 1/8W	907304871
R15	Resistor Metal Film 8.06k Ohm 1% 1/8W	907308061
R16	Resistor Metal Film 27.4k Ohm 1% 1/8W	907302742
R17	Resistor Metal Film 27.4k Ohm 1% 1/8W	907302742
R18	Resistor Metal Film 2.61k Ohm 1% 1/8W	907302611
R19	Resistor Fxd Film 3.01k Ohm 1% 1/8W	907303011
R20	Resistor Fxd Film 3.57k Ohm 1% 1/8W	907303571
R21	Resistor Metal Film 4.75k Ohm 1% 1/8W	907304751
R22	Resistor Metal Film 4.87k ohm 1% 1/8W	907304871
R23	Resistor Metal Film 5.62 Ohm 1% 1/8W	907305621
R24	Resistor Metal Film 6.04k Ohm 1% 1/8W	907306041
R25	Resistor Metal Film 8.45k Ohm 1% 1/8W	907308451
R26	Resistor Fxd Film 10k Ohm 1% 1/8W	907301002
R27	Resistor Metal Film 11.5k Ohm 1% 1/8W	907301152
R28	Resistor Metal Film 5.23k Ohm 1% 1/8W	907305231
R29	Resistor Metal Film 5.23k Ohm 1% 1/8W	907305231
R30	Resistor Fxd Film 4.02k Ohm 1% 1/8W	907304021
R31	Resistor Metal Film 5.36k Ohm 1% 1/8W	907305361
R32	Resistor Metal Film 5.49k Ohm 1% 1/8W	907305391
R33	Resistor Metal Film 5.49k Ohm 1% 1/8W	9C7305391
R34	Resistor Fxd Film 6.19k Ohm 1% 1/8W	907306191
R35	Resistor Metal Film 6.65k Ohm 1% 1/8W	907306651
R36	Resistor Metal Film 7.50k Ohm 1% 1/8W	907307501
R37	Resistor Metal Film 7.87k Ohm 1% 1/8W	907307871
R38	Resistor Metal Film 8.06k Ohm 1% 1/8W	907308061
R39	Resistor Metal Film 5.11k Ohm 1% 1/8W	907305111
R40	Resistor Metal Film 8.66k Ohm 1% 1/8W	907308661
R41	Resistor Metal Film 2.55k Ohm 1% 1/8W	907302551
R42	Resistor Metal Film 4.53k Ohm 1% 1/8W	907304531
R43	Resistor Metal Film 2.94k Ohm 1% 1/8W	907302941
R44	Resistor Metal Film 3.32k Ohm 1% 1/8W	907303321
R45	Resistor Metal Film 3.16k Ohm 1% 1/8W	907303161
R46	Resistor Metal Film 3.74k Ohm 1% 1/8W	907303741
R47	Resistor Metal Film 6.65k Ohm 1% 1/8W	907306651
R48	Resistor Fxd Film 100 Ohm 1% 1/8W	907301000
R49	Resistor Fxd Film 10k Ohm 1% 1/8W	907301002
R50	Resistor Fxd Film 10k Ohm 1% 1/8W	907301002
R51	Resistor Metal Film 221 Ohm 1% 1/8W	907302210
R52	Resistor Metal Film 10 Ohm 1% 1/8W	907310100
R53	Resistor Metal Film 10 Ohm 1% 1/8W	907310100
R54	Resistor Metal Film 221 Ohm 1% 1/8W	907302210
R55	Resistor Metal Film 5.11k Ohm 1% 1/8W	907305111
R56	Resistor Metal Film 49.9 Ohm 1% 1/8W	907349R90

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

Parts List for 415A-2, A6 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
R57	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R58	Resistor Fxd Comp 1k Ohm 5% 1/4W	906900102
R59	Resistor Comp 4.3k Ohm 5% 1/4W	906900432
R60	Resistor Metal Film 619 Ohm 1% 1/8W	907306190
R61	Resistor Metal Film 619 Ohm 1% 1/8W	907306190
R62	Resistor Metal Film 787 Ohm 1% 1/8W	907307870
R63	Resistor Metal Film 1.69k Ohm 1% 1/8W	907301691
R64	Resistor Metal Film 1.21k Ohm 1% 1/8W	907301211
R65	Resistor Metal Film 150 Ohm 1% 1/8W	907301500
R66	Resistor Fxd Film 2.43k Ohm 1% 1/8W	907302431
R67	Resistor Fxd Film 2.43k Ohm 1% 1/8W	907302431
R68	Resistor Metal Film 1.21k Ohm 1% 1/8W	907301211
R69	Resistor Metal Film 1.21k Ohm 1% 1/8W	907301211
R70	Resistor Metal Film 1.21k Ohm 1% 1/8W	907301211
R71	Resistor Fxd Film 432 Ohm 1% 1/8W	907304320
R72	Resistor Fxd Film 1.82k Ohm 1% 1/8W	907301821
R73	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R74	Resistor Fxd Film 3.01k Ohm 1% 1/8W	907303011
R75	Resistor Metal Film 12.1k Ohm 1% 1/8W	907301212
R76	Resistor Metal Film 12.1k Ohm 1% 1/8W	907301212
R77	Resistor Fxd Film 3.01k Ohm 1% 1/8W	907303011
R78	Resistor Metal Film 604 Ohm 1% 1/8W	907306040
R79	Resistor Metal Film 2.15k Ohm 1% 1/8W	907302151
R80	Resistor Metal Film 825 Ohm 1% 1/8W	907308250
R81	Resistor Metal Film 49.9 Ohm 1% 1/8W	907349R90
R82	Resistor Metal Film 5.62 Ohm 1% 1/8W	907305621
R83	Resistor Metal Film 3.09k Ohm 1% 1/8W	907303091
R84	Resistor Metal Film 90.9 Ohm 1% 1/8W	907390R90
R85	Resistor Metal Film 90.9 Ohm 1% 1/8W	907390R90
R86	Resistor Metal Film 82.5 Ohm 1% 1/8W	907382R50
R87	Resistor Metal Film 76.8 Ohm 1% 1/8W	907376R80
R88	Resistor Metal Film 69.8 Ohm 1% 1/8W	907369R80
R89	Resistor Metal Film 63.4 Ohm 1% 1/8W	907363R40
R90	Resistor Metal Film 5.6 Ohm 1% 1/8W	907357R60
R91	Resistor Metal Film 51.1 Ohm 1% 1/8W	907351R10
R92	Resistor Metal Film 41.2 Ohm 1% 1/8W	907346R40
R93	Resistor Metal Film 41.2 Ohm 1% 1/8W	907341R20
R94	Resistor Metal Film 324 Ohm 1% 1/8W	907303240
R95	Resistor Metal Film 5.11k Ohm 1% 1/8W	907305111
R96	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R97	Resistor Metal Film 374 Ohm 1% 1/8W	907303740
R98	Potentiometer 500 Ohm 10% 15 Turn	907900315
R99	Potentiometer 500 Ohm 10% 15 Turn	907900315
R100	Potentiometer 500 Ohm 10% 15 Turn	907900315
R101	Resistor Comp 91 Ohm 5% 1/4W	906900910

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

Parts List for 415A-2, A6 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
R102	Resistor Comp 91 Ohm 5% 1/4W	906900910
R103	Resistor Comp 91 Ohm 5% 1/4W	906900910
R115	Resistor Fxd Film 432 Ohm 1% 1/8W	907304320
R116	Resistor Metal Film 49.9 Ohm 1% 1/8W	907349R90
R117	Resistor Metal Film 49.9 Ohm 1% 1/8W	907349R90
R120	Resistor Metal Film 49.9 Ohm 1% 1/8W	907349R90
R121	Resistor Metal Film 49.9 Ohm 1% 1/8W	907349R90
R122	Resistor Metal Film 49.9 Ohm 1% 1/8W	907349R90
R123	Resistor Metal Film 49.9 Ohm 1% 1/8W	907349R90
R124	Potentiometer 10k 10% 15 Turn	907900281
R125	Resistor Metal Film 51.1 Ohm 1% 1/8W	907351R10
S1	Switch 5 Pole 10 Sec	911200264
S2	Switch Rotary S2-A6	911200268
S3	Switch Rotary S3-A6	911200269
S4	Switch 6 Pole 4 Sec	911200270
T1	Transformer Toroidal 6 MH 20% CTI to ICT	909300013
T2	Transformer Toroidal 6 MH 20% CTI to ICT	909300013
T3	Transformer Toroidal 6 MH 20% CTI to ICT	909300013
T4	Transformer Toroidal 6 MH 20% CTI to ICT	909300013
T5	Transformer Toroidal 6 MH 20% CTI to ICT	909300013
U1	IC LM318N Operational Amp	920310318
U2	IC LM318N Operational Amp	920310318
U3	IC LM318N Operational Amp	920310318
U4	IC SN74LS75N Dual J-K Flip-Flop	920317473
U5	IC CA3127E Transistor Array NPN	920303127
U6	IC SN74LS75N Dual J-K Flip-Flop	920317473
U7	IC SN74LS02	920327402
XY1	Clip Crystal Holding Steel	921100004
XY2	Clip Crystal Holding Steel	921100004
XY3	Clip Crystal Holding Steel	921100004
Y1	Crystal 4.620 MHz	912200195
Y2	Crystal 7.074 MHz	912200259
Y3	Crystal 9.420 MHz	912200197

When given, manufacturer's part numbers are only to aid identification. Equivalent components from other suppliers may sometimes be substituted.

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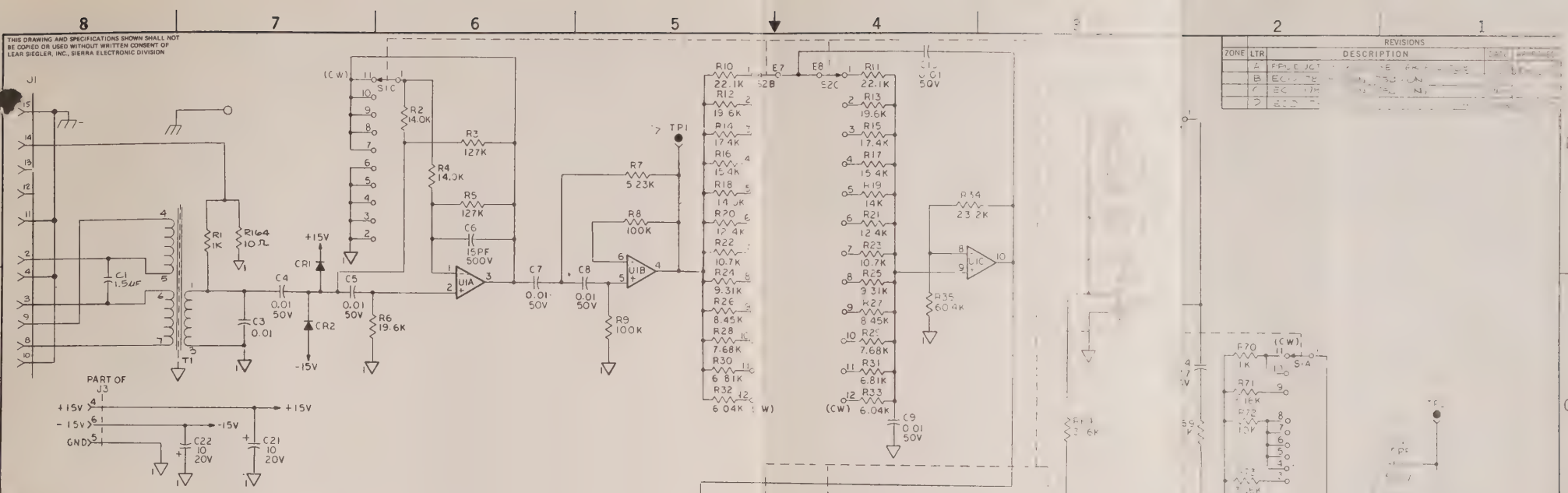

INTEGRATED CIRCUIT SUMMARY DATA					
IC REF DESIGNATION	DEVICE TYPE	+15V	-15V	Vcc	GND
U1,2	RC 4136 DP	11	7		
U3,8	NE 555	------AS SHOWN------			
U4	SN74LS10			14	7
U5	SN74LS197			14	7
U6	SN74LS04			14	7
U7	uA723	------AS SHOWN------			

REFERENCE DESIGNATION DATA		
LAST USED	NOT USED	UNUSED GATES
R163	130,144, 146,150,154, 160,162	
C24		
CR3		
U8		U4-C, U6A-C
T1		
S2		
TP5		

NOTES - UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL RESISTORS ARE 1/8W, ±1%
3. ALL DIODES ARE 1N4148
4. ALL CAPACITANCE VALUES ARE IN MICROFARADS

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
	A	PRODUCT	
	B	EC	
	C	EC	
	D	EC	

QTY	QTY	QTY	QTY	ITEM NO	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST								

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED

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TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .02	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION ±		
FINISH		

Sierra
LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION
MENLO PARK, CALIFORNIA 94025

CODE IDENT. NO. 54778

SCHEMATIC DIAGRAM - RECEIVER A7A

ASSY OR ITEM	QTY NEXT	NEXT ASSY	MODEL NO
	REF	4.5-2	
	APPLICATION		

DATE	SIZE	DRAWING NO	REV
3-23-81	D	D03408300	D
BY KGA-LE			
CHECKED	SCALE	STOCK AS	SHEET 1 OF 2
APPR			

D03408300

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A7 PCB	Power Board Assembly for 415A-2	A03408000
C1	Capacitor Met Mylar 1.5 uF 10% 400V	901100155
C3	Capacitor Ceramic .01 uF 10% 200V	901330103
C4	Capacitor Polycarbonate .010 uF 2% 50V	903100103
C5	Capacitor Polycarbonate .010 uF 2% 50V	903100103
C6	Capacitor Dipped Mica 15 pF 5% 500V	901900150
C7	Capacitor Polycarbonate .010 uF 2% 50V	903100103
C8	Capacitor Polycarbonate .010 uF 2% 50V	903100103
C9	Capacitor Dipped Mica 15 pF 5% 500V	901900150
C10	Capacitor Dipped Mica 15 pF 5% 500V	901900150
C11	Capacitor Dipped Mica 15 pF 5% 500V	901900150
C12	Capacitor Dipped Mica 15 pF 5% 500V	901900150
C13	Capacitor Dipped Mica 15 pF 5% 500V	901900150
C14	Capacitor Ceramic 0.47 uF 20% 50V	901300474
C15	Capacitor Ceramic 0.1 uF 20% 50V	901300104
C16	Capacitor Tantalum 3.3 uF 10% 20V Min	902710335
C17	Capacitor Tantalum 4.7 uF 10% 50 VDCW	902700475
C18	Capacitor Dipped Mica 100 pF 5% 500V	901900101
C19	Capacitor Dipped Tantlex 10 uF 20% 20V	902710106
C20	Capacitor Polycarbonate .010 uF 2% 50V	903100103
C21	Capacitor Dipped Tantlex 10 uF 20% 20V	902710106
C22	Capacitor Dipped Tantlex 10 uF 20% 20V	902710106
C23	Capacitor Dipped Tantlex 10 uF 20% 20V	902710106
C24	Capacitor Dipped Mica 15 pF 5% 500V	901900150
CR 01	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR 02	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR 03	Diode SI 1N4148 75V 150 mA 500 mW	910504148
J1	Connector 15 Pin Molex	914800195
J2	Flexstrip 6 Pin	916400077
J3	Socket Dip 14 Pin	914200086
R1	Resistor Metal Film 1.0k Ohm 1% 1/4W	908351001
R2	Resistor Metal Film 14.0k Ohm 1% 1/8W	907301402
R3	Resistor Metal Film 127k Ohm 1% 1/8W	907301273
R4	Resistor Metal Film 14.0k Ohm 1% 1/8W	907301402
R5	Resistor Metal Film 127k Ohm 1% 1/8W	907301273
R6	Resistor Metal Film 19.6k Ohm 1% 1/8W	907301962
R7	Resistor Metal Film 5.23k Ohm 1% 1/8W	907305231
R8	Resistor Metal Film 100k Ohm 1% 1/8W	907301003
R9	Resistor Metal Film 100k Ohm 1% 1/8W	907301003
R10	Resistor Metal Film 22.1k Ohm 1% 1/8W	907302212
R11	Resistor Metal Film 22.1k Ohm 1% 1/8W	907302212
R12	Resistor Metal Film 10.6k Ohm 1% 1/8W	907301962
R13	Resistor Metal Film 10.6k Ohm 1% 1/8W	907301962
R14	Resistor Metal Film 17.4k Ohm 1% 1/8W	907301742
R15	Resistor Metal Film 17.4k Ohm 1% 1/8W	907301742

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

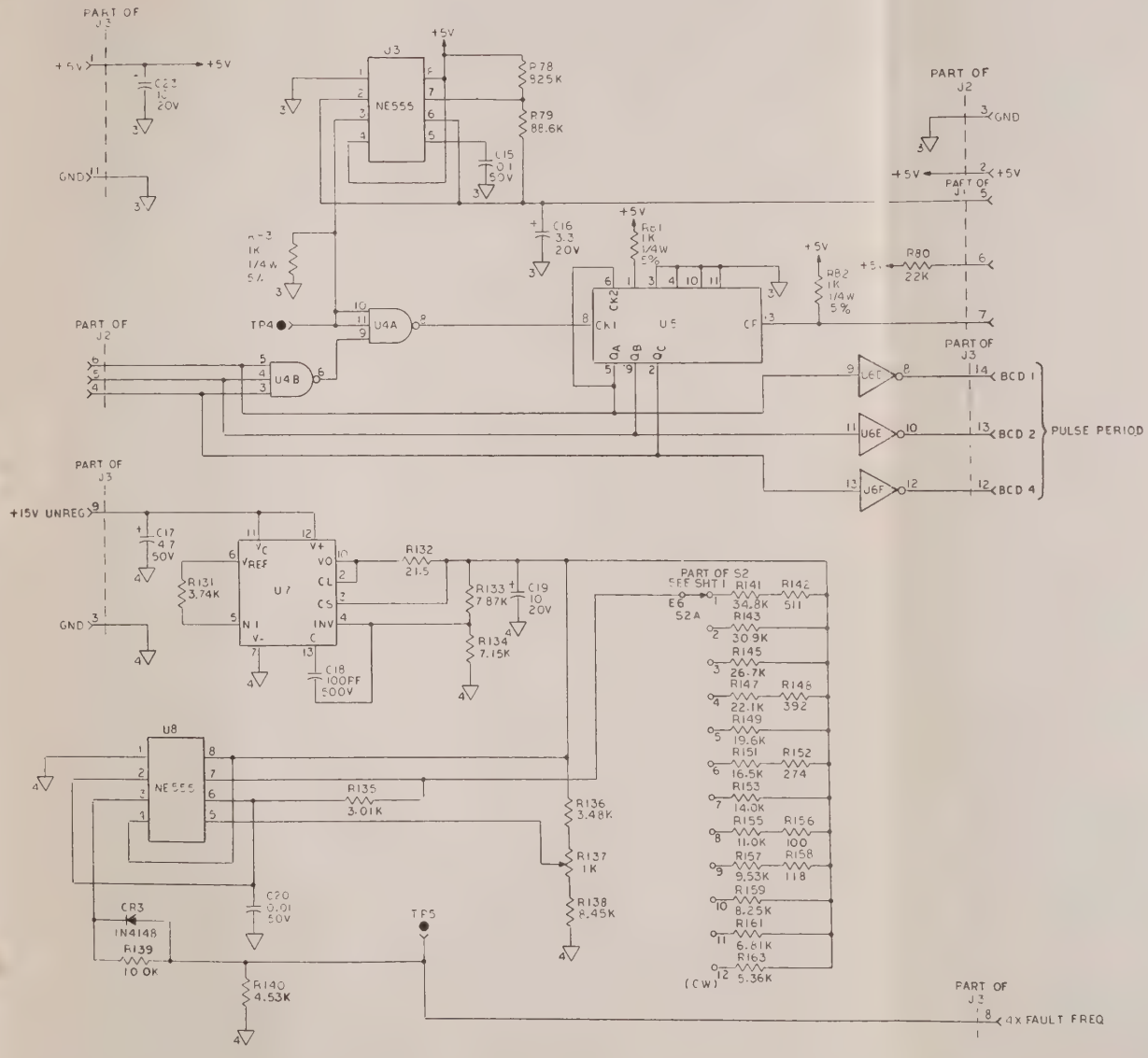
Parts List for 415A-2, A7 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
R16	Resistor Metal Film 17.4k Ohm 1% 1/8W	907301742
R17	Resistor Metal Film 17.4k Ohm 1% 1/8W	907301742
R18	Resistor Metal Film 14.0k Ohm 1% 1/8W	907301402
R19	Resistor Metal Film 127k Ohm 1% 1/8W	907301273
R20	Resistor Metal Film 12.4k Ohm 1% 1/8W	907301242
R21	Resistor Metal Film 12.4k Ohm 1% 1/8W	907301242
R22	Resistor Metal Film 10.7k Ohm 1% 1/8W	907301072
R23	Resistor Metal Film 10.7k Ohm 1% 1/8W	907301072
R24	Resistor Metal Film 9.31k Ohm 1% 1/8W	907309311
R25	Resistor Metal Film 9.31k Ohm 1% 1/8W	907309311
R26	Resistor Metal Film 8.45k Ohm 1% 1/8W	907308451
R27	Resistor Metal Film 8.45k Ohm 1% 1/8W	907308451
R28	Resistor Metal Film 7.68k Ohm 1% 1/8W	907307681
R29	Resistor Metal Film 7.68k Ohm 1% 1/8W	907307681
R30	Resistor Metal Film 6.81k Ohm 1% 1/8W	907306811
R31	Resistor Metal Film 6.81k Ohm 1% 1/8W	907306811
R32	Resistor Metal Film 6.04k Ohm 1% 1/8W	907306041
R33	Resistor Metal Film 6.04k Ohm 1% 1/8W	907306041
R34	Resistor Metal Film 23.2k Ohm 1% 1/8W	907302322
R35	Resistor Metal Film 60.4k Ohm 1% 1/8W	907306042
R36	Resistor Fxd Film 15.0k Ohm 1% 1/8W	907301502
R37	Resistor Fxd Film 15.0k Ohm 1% 1/8W	907301502
R38	Resistor Metal Film 13.3k Ohm 1% 1/8W	907301332
R39	Resistor Metal Film 13.3k Ohm 1% 1/8W	907301332
R40	Resistor Metal Film 11.8k Ohm 1% 1/8W	907301182
R41	Resistor Metal Film 11.8k Ohm 1% 1/8W	907301182
R42	Resistor Metal Film 10.5k Ohm 1% 1/8W	907301052
R43	Resistor Metal Film 10.5k Ohm 1% 1/8W	907301052
R44	Resistor Metal Film 9.53k Ohm 1% 1/8W	907301052
R45	Resistor Metal Film 9.53k Ohm 1% 1/8W	907301052
R46	Resistor Metal Film 7.68k Ohm 1% 1/8W	907307681
R47	Resistor Metal Film 7.68k Ohm 1% 1/8W	907307681
R48	Resistor Metal Film 7.15k Ohm 1% 1/8W	907307151
R49	Resistor Metal Film 7.15k Ohm 1% 1/8W	907307151
R50	Resistor Fxd Film 6.19k Ohm 1% 1/8W	907306191
R51	Resistor Fxd Film 6.19k Ohm 1% 1/8W	907306191
R52	Resistor Metal Film 5.62 Ohm 1% 1/8W	907305621
R53	Resistor Metal Film 5.62 Ohm 1% 1/8W	907305621
R54	Resistor Metal Film 5.11k Ohm 1% 1/8W	907305111
R55	Resistor Metal Film 5.11k Ohm 1% 1/8W	907305111
R56	Resistor Metal Film 4.53k 1% 1/8W	907304531
R57	Resistor Metal Film 4.53k 1% 1/8W	907304531
R58	Resistor Fxd Film 4.02k Ohm 1% 1/8W	907304021
R59	Resistor Fxd Film 4.02k Ohm 1% 1/8W	907304021
R60	Resistor Metal Film 24.9k Ohm 1% 1/8W	907302492

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

THIS DRAWING AND SPECIFICATIONS SHOWN SHALL NOT BE COPIED OR USED WITHOUT WRITTEN CONSENT OF LEAR SIEGLER, INC., SIERRA ELECTRONIC DIVISION

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		ECO		



QTY	QTY	QTY	QTY	ITEM NO	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
						LIST OF MATERIAL OR PARTS LIST		

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED

√ FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED

DO NOT SCALE DWG.

DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .02	±
6 TO 24	± .03	±
ABOVE 24	± .06	±
ANGULAR DIMENSION ±		

FINISH:

Sierra
LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION
MENLO PARK, CALIFORNIA

CODE IDENT. NO. 54778

SCHEMATIC DIAGRAM — RECEIVER A7A

ASSY. OR ITEM	QTY NEXT	NEXT ASSY.	MODEL NO.
		REF	415A-2
APPLICATION			

DATE 3-23-81 | BY NGA LE | CHECKED | APPR

SIZE D | DRAWING NO. D03408300 | REV D

SCALE | STOCK AS | SHEET 2 OF 2

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
R61	Resistor Metal Film 16.2k Ohm 1% 1/8W	907301622
R63	Resistor Metal Film 1.50k Ohm 1% 1/8W	907301501
R64	Resistor Metal Film 3.16k Ohm 1% 1/8W	907303161
R65	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R66	Resistor Metal Film 3.16k Ohm 1% 1/8W	907303161
R67	Resistor Fxd Film 10k Ohm 1% 1/8W	907301002
R68	Resistor Metal Film 31.6k Ohm 1% 1/8W	907303162
R69	Resistor Fxd Film 10k Ohm 1% 1/8W	907301002
R70	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R71	Resistor Metal Film 3.16k Ohm 1% 1/8W	907303161
R72	Resistor Metal Film 31.6k Ohm 1% 1/8W	907303162
R73	Resistor Metal Film 31.6k Ohm 1% 1/8W	907303162
R74	Resistor Metal Film 100k Ohm 1% 1/8W	907301003
R75	Resistor Fxd Film 1.0k Ohm 1% 1/8W	907301001
R76	Resistor Metal Film 100k Ohm 1% 1/8W	907301003
R77	Resistor Metal Film 604 Ohm 1% 1/8W	907306040
R78	Resistor Metal Film 825k Ohm 1% 1/8W	907308253
R79	Resistor Metal Film 86.6k Ohm 1% 1/8W	907308662
R80	Resistor Fxd Comp 22k Ohm 1/4W 5%	906900223
R81	Resistor Fxd Comp 1k Ohm 1/4W 5%	906900102
R82	Resistor Fxd Comp 1k Ohm 1/4W 5%	906900102
R83	Resistor Fxd Comp 1k Ohm 1/4W 5%	906900102
R131	Resistor Metal Film 3.74k Ohm 1% 1/8W	907303741
R132	Resistor Metal Film 21.5 Ohm 1% 1/8W	907321R50
R133	Resistor Metal Film 7.8k Ohm 1% 1/8W	907307871
R134	Resistor Metal Film 7.15k Ohm 1% 1/8W	907307151
R135	Resistor Fxd Film 3.01k Ohm 1% 1/8W	907303011
R136	Resistor Metal Film 3.48k Ohm 1% 1/8W	907303481
R137	Potentiometer 1k Ohm 10% 15 Turn	907900290
R138	Resistor Metal Film 7.68k Ohm 1% 1/8W	907307681
R139	Resistor Metal Film 31.6k Ohm 1% 1/8W	907303162
R140	Resistor Metal Film 45.8k Ohm 1% 1/8W	907304581
R141	Resistor Metal Film 34.8k Ohm 1% 1/8W	907303482
R142	Resistor Metal Film 511 Ohm 1% 1/8W	907305110
R143	Resistor Metal Film 30.9k Ohm 1% 1/8W	907303092
R145	Resistor Metal Film 26.7k Ohm 1% 1/8W	907302672
R147	Resistor Metal Film 22.1k Ohm 1% 1/8W	907302212
R148	Resistor Metal Film 392 Ohm 1% 1/8W	907303920
R149	Resistor Metal Film 19.6k Ohm 1% 1/8W	907301962
R151	Resistor Metal Film 16.5k Ohm 1% 1/8W	907301652
R152	Resistor Metal Film 274 Ohm 1% 1/8W	907302740
R153	Resistor Metal Film 127k Ohm 1% 1/8W	907301273
R155	Resistor Metal Film 11.0k Ohm 1% 1/8W	907301102
R156	Resistor Fxd Film 100 Ohm 1% 1/8W	907301000
R157	Resistor Metal Film 9.53k Ohm 1% 1/8W	907309531

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

Parts List for 415A-2, A7 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
R158	Resistor Metal Film 118 Ohm 1% 1/8W	907301180
R159	Resistor Comp 8.25k Ohm 1% 1/8W	907308251
R161	Resistor Metal Film 6.81k Ohm 1% 1/8W	907306811
R163	Resistor Metal Film 5.36k Ohm 1% 1/8W	907305361
R164	Resistor 10 Ohm 1% 1/8W	907310100
S1	Switch Rotary 10 Pos 3 Sec with 5k Pot	911200277
S2	Switch Rotary 12 Pos 2 Pole 5 Sec 30 Degree	911200276
T1	Transformer MMT 33-M Microtran	909900044
U1	IC RCA136 Quad Operational Amp	920304136
U2	IC RCA136 Quad Operational Amp	920304136
U3	IC LM555CN Timer	920300555
U4	IC SN74LS10N Triple 3 Input Nand Gate	920327410
U5	IC SN74LS197N Binary Counter/Latch	920374197
U6	IC SN74LS04N Hex Inverter	920327404
U7	IC LM723CD Voltage Regulator	920300723
U8	IC LM555CN Timer	920300555

When given, manufacturer's part numbers are only to aid identification.
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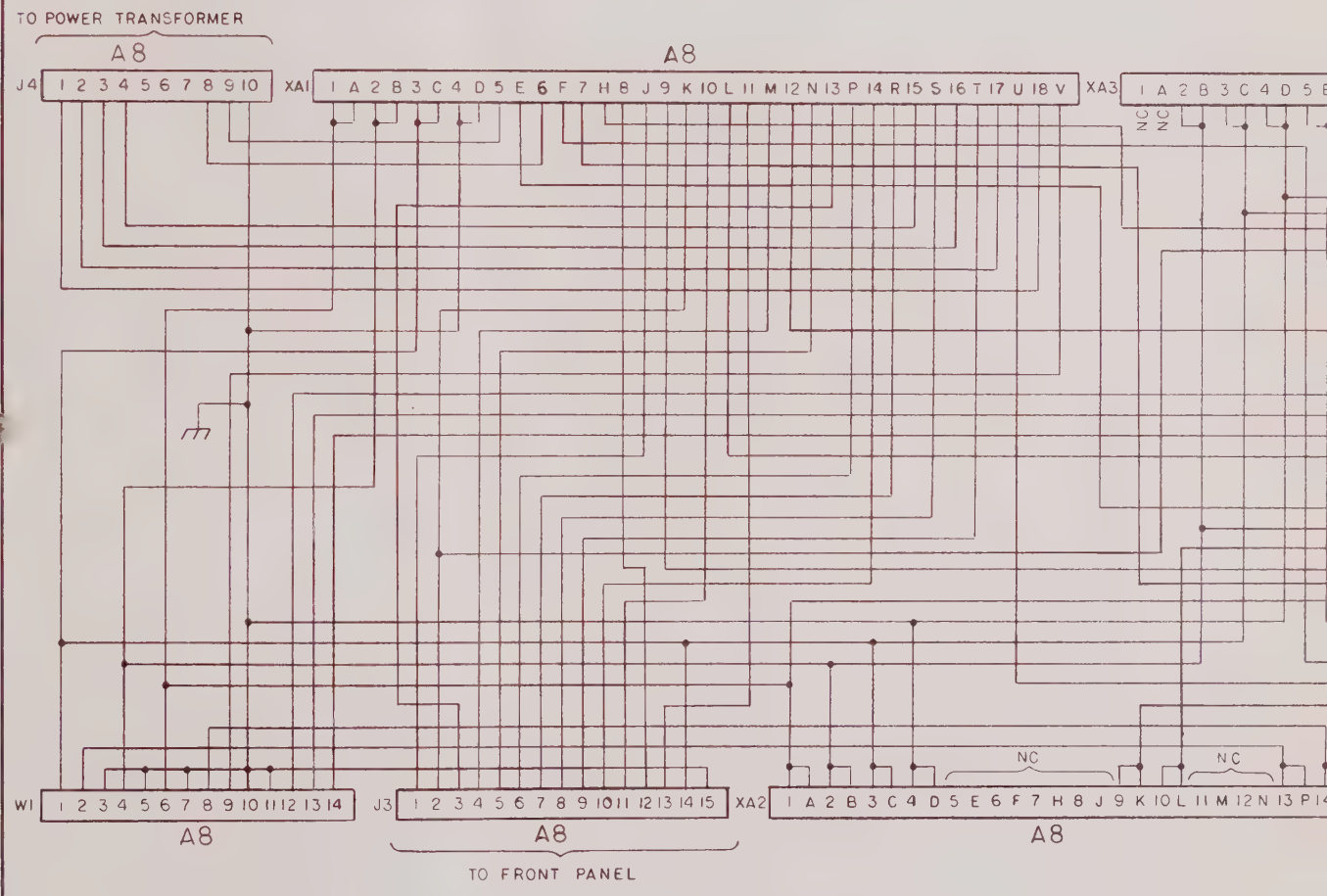
THIS DRAWING AND SPECIFICATIONS SHOWN SHALL NOT BE COPIED OR USED WITHOUT WRITTEN CONSENT OF LEAR SIEGLER, INC., SIERRA ELECTRONIC DIVISION.



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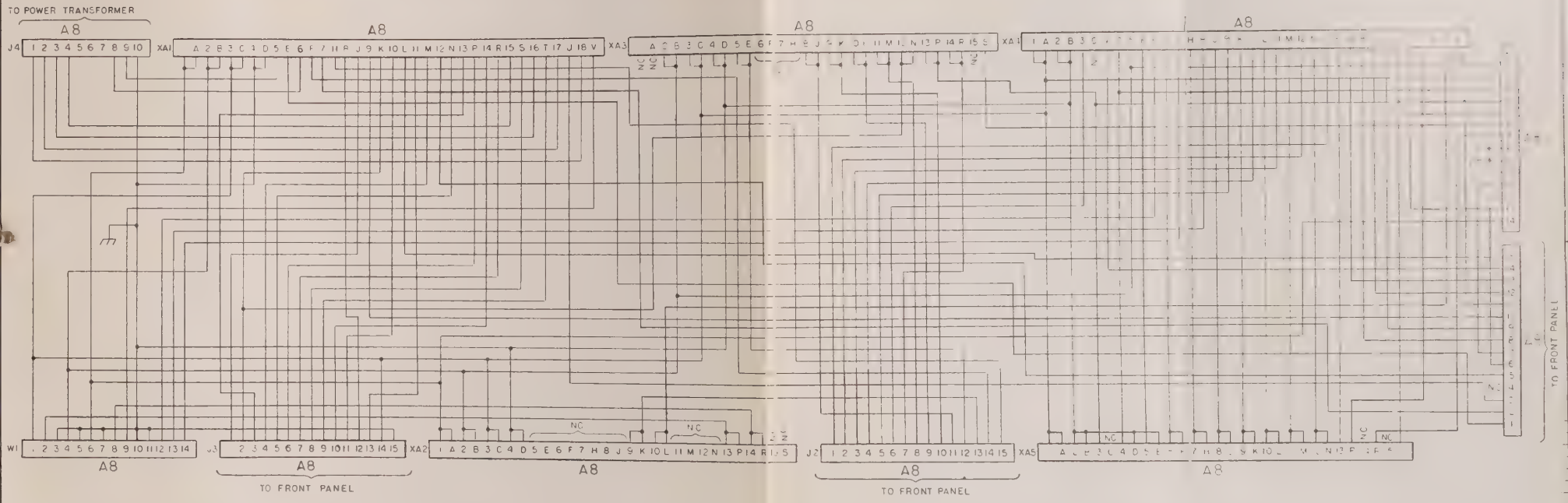

QTY	QTY	QTY	ITEM NO	PART OR IDENTIFYING NO	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE

LIST OF MATERIAL OR PARTS LIST

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED

√ FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED

DO NOT SCALE DWG

DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .02	±
6 TO 24	± .03	±
ABOVE 24	± .06	±

ANG. TAR DIMENSION ±

Sierra

LEAR SIEGLER, INC
SIERRA ELECTRONIC DIVISION
MONTEREY, CALIFORNIA

CODE IDENT. NO. 54778

SCHEMATIC DIAGRAM -
A8
MOTHERBOARD

ASSY OR ITEM	QTY NEXT	NEXT ASSY	MODEL NO
		REF 4151-	

APPLICATION

FINISH

DATE 4/1/81
BY NGA LE
CHECKED
APPR

SIZE D

DRAWING NO LC 440700

REV A

SCALE

STOCK AS

SHEET 1 OF 1

DWG NO 440700

REV A

Parts List for 415A-2, A8 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A8 PCB	Power Board Assembly for 415A-2	D03409200
J1	Connector PC Mtg Wafer Assembly Polarizing	914800195
J2	Connector PC Mtg Wafer Assembly Polarizing	914800195
J3	Connector PC Mtg Wafer Assembly Polarizing	914800195
J4	Connector PC Mtg Wafer Assembly Polarizing	914800193
W1	Cable Dip 14 Pin	916400078
W2	Cable Dip 14 Pin	916400078
XA1	Connector .156 Contact Spacing	914800234
XA2	Connector 15/30 Dip Solder	914800149
XA3	Connector 15/30 Dip Solder	914800149
XA4	Connector .156 Contact Spacing	914800234
XA5	Connector 15/30 Dip Solder	914800149

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

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NOTES - UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL RESISTORS ARE 1/8W, ±1%
3. ALL DIODES ARE 1N4148
4. SEE TABLE "A"
5. ALL TRANSISTORS ARE 2N3904
6. GAIN CONTROL RESISTORS FOR NON-INVERTING OP AMP

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	PILOT RUN RELEASE	[illegible]	[illegible]
	A2	PCO 1452, 1589 RAM	8/17/76	MLD
	B	PREPRODUCTION RELEASE	4/7/77	[illegible]
		PRODUCTION RELEASE	6/7/77	[illegible]
	B1	[illegible]	[illegible]	[illegible]

PART OF J2

+5V

GND

GAIN CONTROL

PULSE PERIOD (BINARY) 2^0, 2^1, 2^2

U1 3-TO-8 LINE DECODER SN 74LS138N

Q1–Q8 2N3906

Q9–Q16 2N3904

CR1–CR8

R1–R8 4.7K 1/4W 5%

PART OF J1

FRONT PANEL LAMP TEST

FRONT PANEL PULSE PERIOD LAMPS CR16, CR15, CR14, CR13, CR12, CR11, CR10, CR9

U4

1	4.7K
2	4.7K
3	4.7K
4	4.7K
5	4.7K
6	4.7K
7	4.7K
8	4.7K

U2,3,5–8

1	2.2K
3	2.2K
5	2.2K
7	2.2K

TABLE "A"

COMP	-11	-2,-4
R1	12.7K	12.7K
R2	14.3K	14.3K
R3	16.5K	16.2K
R4	19.6K	18.7K
R5	24.3K	22.6K
R6	30.9K	28.0K
R7	43.2K	37.4K
R8	73.2K	54.9K

REFERENCE DESIGNATION DATA

LAST USED	NOT USED
R9	
U8	
Q16	
CR16	

QTY	QTY	QTY	QTY	ITEM NO	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE

LIST OF MATERIAL OR PARTS LIST

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TOLERANCE UNLESS SPECIFIED	BASIC	TWO PLACE	THREE PLACE
	UP TO 6	± .02	±
	6 TO 24	± .03	±
	ABOVE 24	± .06	±
	ANGULAR DIMENSION	±	

FINISH:

ASSY OR ITEM	QTY NEXT	NEXT ASSY.	MODEL NO.
			415A-4
			415A-11
			415A-2

APPLICATION

Sierra

LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION MENLO PARK, CALIFORNIA 94025

CODE IDENT. NO. 54778

415A-2,-4,-11

A9 PULSE PERIOD GAIN COMP, LAMP DRIVER

DATE	SIZE	DRAWING NO.	REV.
2-5-77	D	D03198600	C

BY [illegible]

CHECKED

APPR

SCALE

STOCK AS

SHEET 1 OF 1

DWG NO D03198600

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A9 PCB	Power Board Assembly for 415A-2	A03156401
CR1	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR2	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR3	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR4	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR5	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR6	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR7	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR8	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR9	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR10	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR11	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR12	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR13	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR14	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR15	Diode SI 1N4148 75V 150 mA 500 mW	910504148
CR16	Diode SI 1N4148 75V 150 mA 500 mW	910504148
J1	Connector Molex 9 Pin	914800257
Q1	Transistor SI 2N3906 PNP	910303906
Q2	Transistor SI 2N3906 PNP	910303906
Q3	Transistor SI 2N3906 PNP	910303906
Q4	Transistor SI 2N3906 PNP	910303906
Q5	Transistor SI 2N3906 PNP	910303906
Q6	Transistor SI 2N3906 PNP	910303906
Q7	Transistor SI 2N3906 PNP	910303906
Q8	Transistor SI 2N3906 PNP	910303906
Q9	Transistor SI 2N3904 NPN	910303904
Q10	Transistor SI 2N3904 NPN	910303904
Q11	Transistor SI 2N3904 NPN	910303904
Q12	Transistor SI 2N3904 NPN	910303904
Q13	Transistor SI 2N3904 NPN	910303904
Q14	Transistor SI 2N3904 NPN	910303904
Q15	Transistor SI 2N3904 NPN	910303904
Q16	Transistor SI 2N3904 NPN	910303904
R1	Resistor Metal Film 12.7k Ohm 1% 1/8W	907301272
R2	Resistor Metal Film 14.3k Ohm 1% 1/8W	907301432
R3	Resistor Metal Film 16.2k Ohm 1% 1/8W	907301622
R4	Resistor Metal Film 18.7k Ohm 1% 1/8W	907301872
R5	Resistor Metal Film 22.6k Ohm 1% 1/8W	907302262
R6	Resistor Metal Film 28.0k Ohm 1% 1/8W	907302802
R7	Resistor Metal Film 37.4k Ohm 1% 1/8W	907303742
R8	Resistor Metal Film 54.9k Ohm 1% 1/8W	907305492
R9	Resistor, Fxd Comp 4.7k Ohm 5% 1/4W	906900472
U1	IC SN74LS138N Decoder/Multiplexer	920374138
U2	Resistor Isolated Network 2.2k Ohm 2% 1/8W	920880222

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

Parts List for 415A-2, A9 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
U3	Resistor Isolated Network 2.2k Ohm 2% 1/8W	920880222
U4	Resistor Common Jct Network 4.7k Ohm 2% 1/8W	920680472
U5	Resistor Isolated Network 2.2k Ohm 2% 1/8W	920880222
U6	Resistor Isolated Network 2.2k Ohm 2% 1/8W	920880222
U7	Resistor Isolated Network 2.2k Ohm 2% 1/8W	920880222
U8	Resistor Isolated Network 2.2k Ohm 2% 1/8W	920880222

When given, manufacturer's part numbers are only to aid identification.
Equivalent components from other suppliers may sometimes be substituted.

Parts List for 415A-2, A9 Board

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
U3	Resistor Isolated Network 2.2k Ohm 2% 1/8W	920880222
U4	Resistor Common Jct Network 4.7k Ohm 2% 1/8W	920680472
U5	Resistor Isolated Network 2.2k Ohm 2% 1/8W	920880222
U6	Resistor Isolated Network 2.2k Ohm 2% 1/8W	920880222
U7	Resistor Isolated Network 2.2k Ohm 2% 1/8W	920880222
U8	Resistor Isolated Network 2.2k Ohm 2% 1/8W	920880222

When given, manufacturer's part numbers are only to aid identification. Equivalent components from other suppliers may sometimes be substituted.

Parts List for 415A-2, Front Panel Assembly

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
FP	Front Panel Assembly 415A-2	(See Note 2)
DS1	Lampholder White*	913800063
DS2	Lampholder White*	913800063
DS3	Lampholder White*	913800063
DS4	Lampholder White*	913800063
DS5	Lampholder White*	913800063
DS6	Lampholder White*	913800063
DS7	Lampholder White*	913800063
DS8	Lampholder White*	913800063
DS9	Lampholder Red*	913800065
DS10	Lampholder Red*	913800065
DS11	Lampholder Red*	913800065
DS12	Lampholder Green*	913800064
DS13	Lampholder White*	913800063
DS14	Lampholder Red*	913800065
FP7	Meter Bezel	920400032
FP15	Lamp Incandescent TI Flange Base*	913800060
J1	Jack Phone 310	914400024
J2	Jack Phone 310	914400024
J3	Jack Phone 310	914400024
J4	Jack Phone 310	914400024
J5	Jack Phone 310	914400024
J6	Jack Phone TT	914400036
J7	Jack Phone TT	914400036
M1	Meter	911800160
R1	Potentiometer 25k Ohm	907900376
S1	Switch Rotary	911200263
S2	Switch Toggle DPDT	911000087
S4	Switch Toggle 3PDT	911000086
S6	Switch Toggle 3PDT	911000086

*Note: On test sets with Serial Numbers 3249 and up, incandescent bulb indicators have been replaced with LED indicators:

Red LED indicator	913800098
Yellow LED indicator (replaces white)	913800099
Green LED indicator	913800100

Note 2: On instruments of early manufacture, the front panel is Sierra Part Number A03239500; on those of more recent manufacture, it is Sierra Part Number A03553800. Before ordering, contact Customer Service at the factory with the Serial Number of the instrument under repair, to obtain instructions.

When given, manufacturer's part numbers are only to aid identification. Equivalent components from other suppliers may sometimes be substituted.